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ABSTRACT

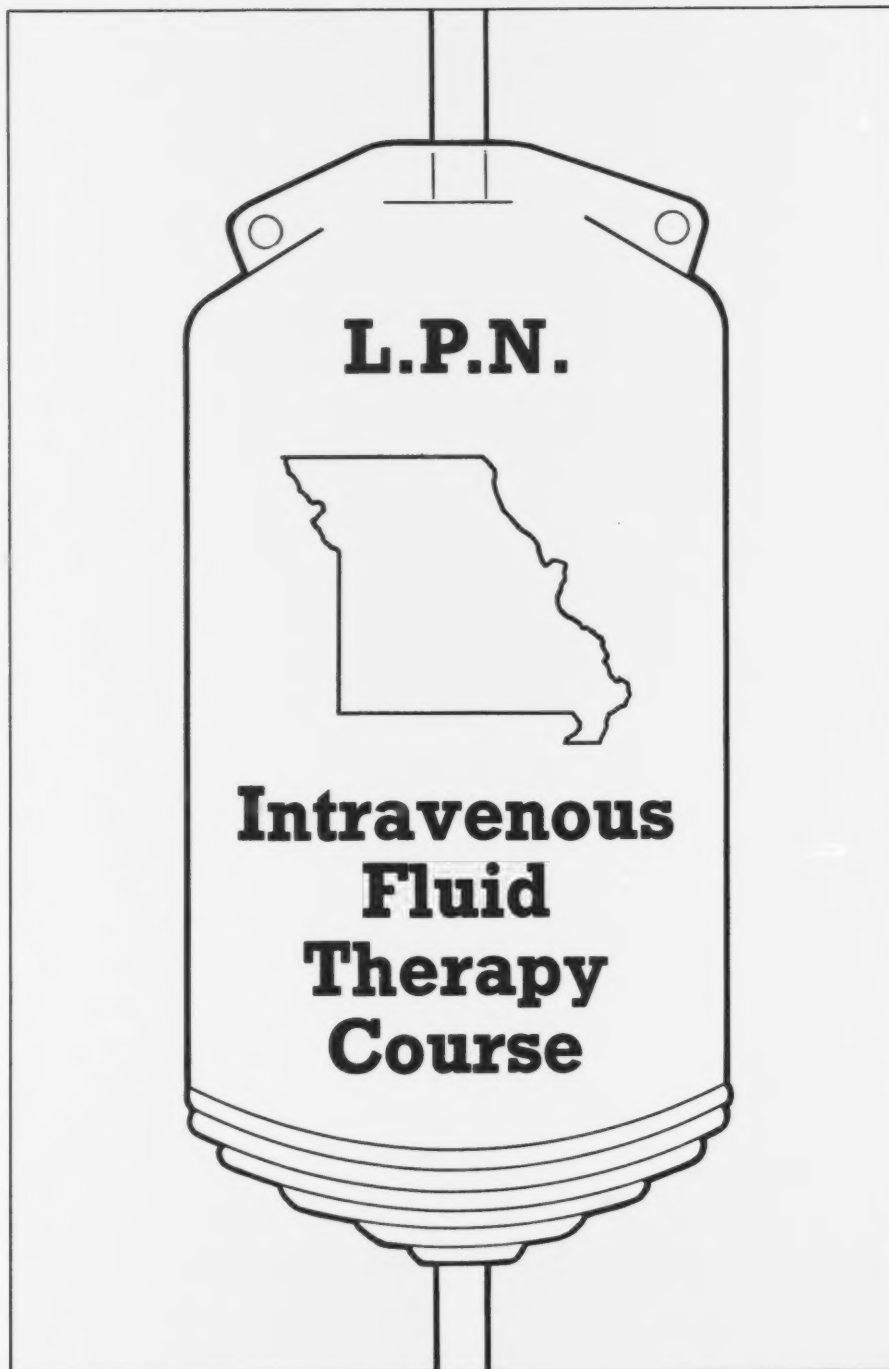
This curriculum guide provides materials for a 10-unit intravenous (IV) therapy course for licensed practical nurses. Units contain from one to nine lessons. The first unit provides an introduction and orientation to the course. Subsequent units concern documentation, anatomy and physiology as applied to IV therapy, fundamental aspects of fluid and electrolyte balance, recognition and prevention of IV therapy-related complications, administration of IV fluid therapy, IV fluid therapy maintenance, pharmacological considerations of IV medication, blood transfusion therapy, and total parenteral nutrition. Each lesson contains the following components: scope of unit, lesson objectives, informational assignment, references, introduction, outline of content, summary and conclusion, interaction items (questions to stimulate and encourage student interaction), classroom/laboratory activities, and evaluation items. Handouts, assignment sheets, and transparency masters are also provided as needed. The document concludes with a bibliography, a chart of learning objectives to record student achievement, and a certificate. (YLB)

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INTRAVENOUS FLUID THERAPY COURSE
FOR THE LICENSED PRACTICAL NURSE
Instructor Guide

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PREFACE

Historical Development

Initial legislation was passed in the state of Missouri on April 12, 1984, which allows licensed practical nurses to perform many intravenous therapy functions after successful completion of an Intravenous Therapy Course approved by the Missouri State Board of Nursing. Several vocational schools and hospitals developed curriculum designs and were approved by the board to teach the program. After evaluating the success and satisfaction of concerned persons, the board responded with revision of the legislation in November of 1985.

A survey of LPNs who completed approved programs was conducted. Many of the comments resulting from that survey referred to a lack of consistency and quality between programs. Even though all curriculum designs are approved by the board, the course content suggests that a great deal of disparity exists between schools. Often programs are presented by registered nurses who are expert clinicians but not teachers. Although the program content has board approval, non-teacher instructors often lack insight into educational taxonomy. In such instances, instructors may be unable to translate their own skills into a language which another person can comprehend and develop into a skill of his or her own. This may account for some programs receiving high accolades on evaluations while others are rated as less successful.

An outgrowth of these comments resulted in a project, funded by the Department of Elementary and Secondary Education (DESE), to develop a comprehensive curriculum guide that will bring more assurance of consistency and quality of programs of intravenous therapy for LPNs.

Project Development

There existed a need to develop a curriculum guide that would include lesson plans and evaluation items which would provide direction for instructors. The Instructional Materials Laboratory, University of Missouri, responded to a research fund prospect published by Health Occupations Educations, DESE. The first step in the project was the development of a technical committee composed of practical nursing educators who had already taught an approved program, industry representatives conducting programs, and a liaison from the board. The technical committee developed a task analysis consistent with the board's criteria of necessary elements in the course. Writers were selected to develop lesson plans with enabling learning objectives that would provide instruction for each task listed on the analysis. Ada Plumer's Principles and Practices of Intravenous Therapy was the primary resource/reference text. Upon completion of the developmental phase, the project entered a field-testing stage. Members of the technical committee and selected others participated in the field-testing by actually teaching the newly developed materials in the classroom. Their comments became the basis of the final revisions to the curriculum.

Curriculum Content

The lesson plan format is both student and teacher centered. It is an organizational tool for the instructor as well as a learning aid for the student. The lesson plans allow the curriculum guide to be prepared in short, manageable segments. Each lesson contains the following components:

Scope of Unit: A teacher-centered statement that includes the goals of the unit; allows the reader to see the comprehensive content of each lesson

Lesson Objectives: A listing of skills the student will be able to perform as a result of the lesson; provides the basis for evaluation

Information Assignment: An assignment for which the student is responsible

Reference: Resources the instructor uses to support the unit content

Introduction: A statement that sets the stage for the learning of the content; tells the student why the lesson is important

Outline: The content of the lesson; may be informative in nature or it may be the steps of a procedure to learn a skill

Summary and Conclusion: Reassimilates all the information that was included in the content of the lesson; ties the information together in a comprehensive overview; purpose is to reinforce learning by summarizing major components of the lesson

Interaction Items: Questions intended to stimulate and encourage student interaction during the lesson presentation; allow the instructor to build on students' previous learning as well as dispel any misconceptions

Classroom/Laboratory Activities: Activities designed to reinforce learning; allow students to interact with the new information or materials contained in the lesson

Evaluation Items: An exercise designed to measure the accomplishment of the lesson objectives; may be a written evaluation or skills demonstration

Approved Model Curriculum

At the meeting of the Missouri State Board of Nursing on April 11-14, 1988, the members of the Board approved the model curriculum proposed by the Department of Elementary and Secondary Education. The Board further moved that the State Board of Nursing newsletter be used to announce publication of the approved curriculum. Facilities or institutions that choose to use the curriculum may do so by notifying the board and would not be required to submit curriculum as part of a proposal to offer an IV Therapy Course.

V. Arrowood

INTRAVENOUS FLUID THERAPY COURSE

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INTRAVENOUS FLUID THERAPY COURSE FOR THE LPN

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DOCUMENTATION

2. Documentation
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3. The skin
 4. The circulatory system
 5. The cardiopulmonary system
 6. Hematology
-

FUNDAMENTAL ASPECTS OF FLUID AND ELECTROLYTE BALANCE

7. Fluids and electrolytes
 8. Fluid and electrolyte imbalances
 9. Parenteral fluids
-

RECOGNITION AND PREVENTION OF IV THERAPY-RELATED COMPLICATIONS

10. Local and systemic complications
 11. Infection control
-

ADMINISTRATION OF INTRAVENOUS FLUID THERAPY

- | | |
|---|--|
| | 12. Patient approach |
| | 13. Identifying IV therapy equipment |
| 14. Preparation for the establishment
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| 15. Insertion of the intravenous
over-the-needle cannula | |
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winged-tip needle | |
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| | 18. Principles of pediatric
intravenous therapy |
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-

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- | | |
|--|---|
| | 20. Principles of maintenance of
intravenous fluid therapy |
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| 23. Use of armboards and restraints | 23. Use of armbands and restraints |
| 24. Care of infusion site | 24. Care of infusion site |
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- 28. Adverse reactions to intravenous drug administration
- 29. Dosage calculations in intravenous drug administration
- 30. Piggyback administration of intravenous drugs with continu-flo tubing
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- 36. Transfusion therapy
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- 38. Total parenteral nutrition and nursing practice

HISTORICAL OVERVIEW OF INTRAVENOUS THERAPY

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Man's fascination with the concept of administering various substances, including blood, is certainly not new. This concept extends back to the early times of the Egyptians and the Romans when it was believed that blood obtained from the strong and healthy would transmit youth and vigor to the aged and infirm. These first administrations of blood were not via the intravascular route, but were drafts that were ingested orally.

Only after the mechanics of the circulation were discovered by William Harvey, with subsequent publication of his theory in 1628, did transfusion of blood become possible. Harvey's published treatise on circulation resulted in English physiologists performing a variety of experiments on animals which were later documented in the Transactions of Royal Society.

In 1656, noted architect and artist Sir Christopher Wren worked with Robert Boyle, a chemist, to demonstrate that access to the entire body could be achieved by using a goose quill and pig bladder to cannulate the foreleg vein of a dog and injecting opium, thus producing a systemic effect. Sir Wren's colleagues at Oxford University and the Royal Society extended the research to human subjects and six years later the first successful intravenous injection was performed on a human by J.D. Majors, a German physician.

The first recorded transfusion of blood to a human subject was performed by Jean Baptiste Denis, physician to Louis XIV. Dr. Denis transfused nine ounces of lamb blood to a fifteen year old Parisian male suffering from luetic madness. Although the patient passed black urine, Dr. Denis continued the therapy which resulted in the death of the patient after the third transfusion was administered. The patient's wife charged Dr. Denis with murder. Although acquitted of the murder charge, Dr. Denis was not permitted to continue his transfusion experiments without accreditation of the medical faculty of the University of Paris. Dr. Denis never obtained the required accreditation and church-supported laws were later enacted which prohibited transfusions in Europe. During the next 150 years, animal blood transfusion experiments continued, but transfusion as a medical practice lay dormant until the concept was revived at the University of Edinburgh in the late eighteenth century.

The Edinburgh scholar and obstetrician James Blundell is regarded as the "father of blood transfusion." After performing extensive studies on dogs and developing usable equipment, Dr. Blundell began to administer blood to patients who developed postpartum hemorrhage. Although Dr. Blundell did prove that only human blood was appropriate for administration, complications continued to persist. Since there was no knowledge of blood groups, hemolytic reactions frequently occurred and infections were common, often resulting in not only the demise of the recipient but that of the donor as well.

The discovery of the principle of antisepsis by Louis Pasteur and John Lister was a major advance, however resistance to acceptance of this principle and limitations in the manufacture of products prevented immediate application. During the great

cholera epidemic of 1811 in Western Europe, Scottish physician Dr. Thomas Latta treated the associated intractable diarrhea with intravenous administration of large volumes of saline. Even though this treatment proved successful in some cases, persistent complications of infection and death continued to be serious problems.

Experiments involving injections of various substances into animals continued with moderate success but there was generally a lack of interest in intravenous therapy until the beginning of the twentieth century. It was at this time that American pathologist Dr. Karl Landsteiner and his associates identified the four major blood types--A, B, AB, and O--in the ABO blood groups system. Two other notable events which occurred in the first decade of the twentieth century were the first intravenous infusions of glucose for nutritional purposes during surgery, and the discovery by Hustin (a Belgian) of the efficacy of sodium citrate as an anticoagulant for transfusions. Subsequent standardized dosages of sodium citrate resulted in successful indirect blood transfusions. It was also during this period that Henriques and Anders experimented with hydrolyzed protein infusions in animals and Murlin and Riche conducted experiments with fat emulsions in animals. These were the first steps toward development of hyperalimentation, a treatment modality which is routinely used today.

One of the most significant events of the twentieth century was the discovery of pyrogens (proteins which are foreign to blood) by Dr. Florence Seibert in 1923. Subsequent refinement of sterilization techniques used to remove pyrogens from intravenous fluids and drugs contributed greatly to the provision of safe intravenous therapy.

Until 1925 normal saline solution was the most commonly infused parenteral solution. Dextrose began to be used extensively after 1925 to make isotonic solutions and to provide a source of calories.

In the 1930s, administration of intravenous infusion was considered a major procedure reserved exclusively for the extremely ill patient. Physicians performed all venipunctures with nurses assisting. It was not until World War II when civilian physicians were in short supply that select nurses began to assume the responsibility for intravenous therapy procedures. In 1940 Massachusetts General Hospital became one of the first hospitals to designate registered nurses as IV therapists. It was during this same year that Dr. Karl Landsteiner and Dr. Alexander Weiner discovered the Rhesus factor, Rh negative and Rh positive blood.

Prior to World War II, the only type of cannula in use was the metal needle which resulted in frequent infiltration, discomfort to the patient, and greater risk of cross-contamination because it was nondisposable. In 1945 flexible plastic tubing known as an intravenous catheter became available. This catheter was introduced into the vein by means of a needle or the minor surgical procedure of cutdown. Five years later the Rochester needle was introduced by Mayo Clinic anesthesiologist Dr. David J. Massa, and Emil Gauthier of the Rochester Products Company. It consisted of a resinous catheter on the outside of a steel needle that was slipped off the needle and into the vein. The needle was then removed. In the late 1950s the Intracath, a plastic catheter lying within the lumen of the needle, was introduced in individual sterile packaging by Deseret Pharmaceutical Co., Inc. Both the Rochester Needle and the Intracath greatly reduced the need for performing the cutdown procedure. Changes in the steel needle also occurred when McGaw Laboratories manufactured small needles with rubber grips designed like an inverted T. Refinements of this design resulted in the winged infusion set in common usage today.

Other notable advances which occurred during the 1950s include: introduction of commercially-produced plastic bags for the collection and storage of blood; development by Dr. Edward J. Cohn of the Harvard Medical School of the cell separator which led to successful blood component therapy; and development of the Harvard Infusion Pump. It was also during this decade that the percutaneous approach to the subclavian vein was first described by Aubanic.

The 1960s brought a totally new approach to intravenous therapy and respite to the starving patient when members of the Harrison Department of Surgical Research at the University of Pennsylvania conducted experiments on juvenile beagle dogs which revealed that sufficient nutrients could be administered intravenously to support normal growth and development. Dr. Stanley Dudrick made medical history in July, 1967 at Children's Hospital in Philadelphia when he successfully hyperalimented a severely ill infant.

The 1970s opened a decade of tremendous scientific, technological, and medical advancement as intravenous therapy received recognition as a highly-specialized area of clinical nursing. As a result, industry responded by developing and producing equipment to promote patient safety and comfort. Noteworthy examples of such equipment include: refined administration set systems; in-line filters that limit introduction of particulate matter, bacteria, and fungus to the intravascular system; and automated infusion pumps, controllers and monitors. Commercially-prepared parenteral fluids to meet every need of the patient also began to appear.

Dr. Robert A. Hickman, a pediatric nephrologist, developed the Hickman catheter for use with patients receiving bone marrow transplants. The Hickman catheter was used in conjunction with a new insertion technique that created a subcutaneous tunnel between the skin exit site of the catheter and the vein insertion site. This tunneling allowed the catheter to be left in place indefinitely and reduced infections that occurred when catheters were inserted directly through the skin into a vein.

Nursing responsibility for the performance of many intravenous procedures formerly reserved for medical staff such as intraarterial therapy, neonatal therapy, and chemotherapy increased in the 1970s as the concept of the intravenous therapy team became more widely accepted. Another important milestone in the 1970s was the establishment of professional organizations to provide forums for the exchange of ideas, information, experience, and knowledge with the goal of developing standards and elevating the quality of patient care.

In the 1980s parenteral solution containers with premixed additives and multilumen central venous catheters became commercially available with subsequent widespread acceptance by the medical community. Pharmacia Laboratories made a significant contribution to intravenous therapy during this decade with the development of a totally implantable intravascular drug delivery system. This unique system allows for the delivery of virtually all parenteral fluids, intravenous drugs and blood/blood components to the patient requiring long-term intravascular access with minimal occurrences of complications.

The National Intravenous Therapy Association, Inc. published Standards of Intravenous Care in the early 1980s and further enhanced the quality of intravenous therapy in 1985 when the organization began to provide credentialing in the clinical nursing specialty through stringent testing of candidates.

Legislation was enacted in the state of Missouri on April 12, 1984 and revised in November of 1985 to allow licensed practical nurses to perform many intravenous therapy functions after successful completion of an IV therapy certification program approved by the Missouri State Board Of Nursing.

In an effort to enhance the image and identity of its members as registered nurses specializing in the practice of IV nursing, the National Intravenous Therapy Association, Inc. changed its name to the Intravenous Nurses Society, Inc. (INS) in 1987.

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LESSON PLAN: 1
COURSE TITLE: INTRAVENOUS FLUID THERAPY
UNIT I INTRODUCTION

SCOPE OF UNIT:

This unit introduces participants to the structure of the course which includes objectives, performance criteria, and resources. It contains an introduction to the legal responsibilities associated with intravenous fluid therapy as well as the rationale for intravenous therapy administration.

INFORMATION TOPIC: X OR DEMONSTRATION:

ORIENTATION TO THE IV FLUID THERAPY COURSE
(Lesson Title)

LESSON OBJECTIVES - THE STUDENT WILL BE ABLE TO:

1. Successfully complete a pretest on anatomy and physiology.
2. Successfully complete a pretest on pharmacology.
3. Successfully complete a pretest on asepsis.
4. Define the purpose of the Intravenous Fluid Therapy Course.
5. Identify five objectives of the Intravenous Fluid Therapy Course.
6. Define administration of intravenous fluid treatment as contained in the Missouri Nursing Practice Act.
7. Identify five duties and functions of the LPN in performing intravenous fluid therapy as defined by the Missouri Nursing Practice Act.
8. Explain how institutional policies may differ from state regulations.
9. Identify examples of incidents which constitute negligence or malpractice in the performance of IV therapy.
10. Identify basic principles which may assist in avoiding lawsuits claiming malpractice.

SUPPLEMENTARY TEACHING/LEARNING ITEMS:

1. HO 1: State of Missouri Nursing Practice Act
2. HO 2: Rule CSR 200-6.010, Intravenous Fluid Treatment Administration
3. HO 3: LPN/IV Therapy Rule: Board Clarifications/Interpretations/Decisions
4. AS 1: Anatomy and Physiology Pretest
5. AS 2: Pharmacology Pretest
6. AS 3: Asepsis Pretest
7. Course syllabus (provided by instructor)

INFORMATIONAL ASSIGNMENT:

Plumer, Ada Lawrence. Principles and Practice of Intravenous Therapy. 4th ed. Boston: Little, Brown & Co., 1987.

REFERENCES: (Instructor's Additional Information)

Becker, Betty Glare and Dolores T. Fendler. Professional Vocational Relations. St. Louis: C.V. Mosby Co., 1982.

CSR 200-6.010 - Intravenous Fluid Treatment Administration, effective November 11, 1985.

Plumer, Ada Lawrence. Principles and Practice of Intravenous Therapy. 4th ed. Boston: Little, Brown & Co., 1987.

INTRODUCTION:

Intravenous therapy has come a long way since 1628. In the 1940s, the sole requisite of the intravenous nurse was the ability to perform a venipuncture skillfully. Today, millions of patients are receiving highly-specialized intravenous therapy. Long-term antibiotic therapy, chemotherapy, and hyperalimentation are administered in the home. This can be done by establishing guidelines and utilizing specialized nursing personnel. The need for specialized personnel has prompted such courses as this. As medical achievements continue, the health care industry will keep pace and so should we, as nurses, to provide the best quality care available to our patients.

In any nursing duty we perform, we are accountable for our actions--accountable to the Missouri State Board of Nursing, the public, the patient, our employing agency, our immediate supervisor, and to ourselves. This accountability is based on three factors: knowledge, skills, and judgment. This lesson addresses the need for safe, sound knowledge, unquestionable skills, and sound nursing judgments. This is the triangle of legal responsibility.

LESSON PLAN: I
COURSE TITLE: INTRAVENOUS FLUID THERAPY
UNIT I INTRODUCTION

INSTRUCTOR NOTE: Administer AS 1, AS 2, AS 3 (Pretests) prior to presenting this information lesson.

OUTLINE: (Key Points)

I. Entry Level Skills/Requirements

- A. Currently licensed as a licensed practical nurse in the state of Missouri
- B. Completion of a pretest in pharmacology, anatomy, and physiology, and principles of asepsis, to be used as a tool to evaluate entry-level knowledge
- C. Evidence of current coverage of individual malpractice insurance

II. Introduction to the Intravenous Fluid Therapy Course

A. Purpose (II-1)

The purpose of the Intravenous Fluid Therapy Course shall be to prepare licensed practical nurses to perform limited intravenous fluid therapy treatment utilizing the knowledge, skills, and competencies required to perform such therapy safely and in accordance with the Missouri Nursing Practice Act, ACSR 200-6.010, effective April 12, 1984, and revised November 11, 1985.

B. Description

A forty-eight (48) hour course designed for licensed practical nurses to perform limited intravenous fluid therapy as outlined by 4CSR 200-6.010, the regulatory agency being the Missouri State Board of Nursing. It should be noted that institutional policies and protocol define and limit the role of the licensed practical nurse in intravenous fluid treatment administration in that institution.

C. Course objectives (II-2)

Upon successful completion of the Intravenous Fluid Therapy Course, the licensed practical nurse will be able to:

- 1. Relate the Missouri Nursing Practice Act to the role of the licensed practical nurse in performing limited fluid treatment.

2. Function according to the policies and procedures of the employing institution and within the rules and regulations set forth by the Missouri State Board of Nursing, recognizing his/her responsibility to the patient, institution and the nursing profession in the provision of intravenous therapy.
3. State the relationship between intravenous fluid administration and body's homeostatic and regulatory functions.
4. Correlate fluid and electrolyte imbalances with the associated clinical manifestations.
5. Demonstrate knowledge of drug and solution compatibility and incompatibility.
6. Identify indications for performing intravenous therapy.
7. Relate drug actions, interactions, adverse reactions, methods of administration, and assessment to the nursing management of the patient receiving intravenous fluid treatment.
8. Select appropriate equipment as indicated by the particular intravenous therapy ordered by the physician and delegated by the registered professional nurse.
9. Describe the anatomical structures and functions of veins utilized as venipuncture sites.
10. Differentiate various venipuncture sites and use selectivity in the choice of sites, based on ordered intravenous therapy.
11. Aseptically prepare a site for venipuncture.
12. Demonstrate aseptic technique in the administration of intravenous medication peripherally with devices not to exceed three (3) inches in length.
13. Demonstrate the venipuncture procedure, via return demonstration, including the psychological preparation of the patient, site selection, collection and preparation of equipment, skin preparation, venipuncture, anchor of devices, and concise, legible documentation of entire procedure.
14. Demonstrate maintenance techniques for intravenous therapy and perform concise, legible documentation of same.
15. Recognize the signs and symptoms of local and systemic complications of intravenous fluid and drug therapy.
16. Perform concise, legible documentation of signs and symptoms of local and systemic complications of intravenous fluid and drug therapy, stating appropriate actions.

17. Accurately calculate the rate of flow of intravenous fluid infusion and drug dosages.
18. Perform all procedures involved in the maintenance of an intravenous fluid treatment administration system with special emphasis on monitoring rate of infusion, care of site, changing of containers, adding parenteral solutions to existing patent intravenous lines, changing of tubings, changing of dressings, discontinuing infusions, and appropriate treatment with concise, legible documentation.
19. Add designated premixed medication to existing patent intravenous lines via intravenous piggyback, either by continuous or intermittent methods.
20. State the rationale for special intravenous fluid treatment, such as heparin lock.
21. Demonstrate the procedure for insertion and maintenance of heparin locks.
22. Perform concise, legible documentation of insertion and maintenance of patency of heparin locks.
23. Monitor transfusions of blood and blood components.
24. Perform accurate, concise, and legible documentation of the patency and maintenance of blood and blood component transfusion.
25. Administer drugs via intravenous push in life-threatening situations under the direction of a registered nurse or physician.
26. Perform accurate, concise, legible documentation of drugs administered IVP in life-threatening situations.

D. Attendance

1. Records of attendance shall be maintained.
2. Attendance is required in all classroom and clinical settings assigned.
3. Notification to appropriate instructor is required if absences occur in order that agreeable make-up schedule can be arranged.

E. Dress

1. Classroom wear will be normal attire.

2. Clinical sessions will require

- a. Uniform
- b. White shoes
- c. White hose or socks
- d. Cap (if applicable)
- e. Name tag
- f. School pin

F. Instructional design

1. Classroom/practice laboratory

- a. The course shall consist of forty (40) classroom hours of instruction.
- b. Classes shall be held 3-8 hours per day for a total of forty (40) hours to accommodate the practicing licensed practical nurse.

2. Clinical sites

- a. There shall be a minimum of eight (8) hours of clinical practice under the supervision of a registered professional nurse.
- b. The final practical examination shall be conducted in the clinical facility under the supervision of the instructor and shall include evaluation of the achievement of the clinical objectives for the course.
- c. Faculty-student ratio shall not exceed three (3) licensed practical nurses to one (1) instructor.

G. Suggested text

Plumer, Ada Lawrence. Principles and Practices of Intravenous Therapy. 4th ed. Boston: Little, Brown & Company, 1987.

H. Evaluation methods/criteria

- 1. Achieved score as determined by institutional criteria on the final examination
- 2. One hundred (100) percent accuracy on the final practical examination to be administered by the clinical instructor at a cooperating health care agency

I. Required documentation

1. Final records shall include a list of competencies and test scores.
2. The training agency/institution shall maintain the records of individuals who have successfully completed this course for a period of at least five years..
3. The training agency/institution shall submit the names, addresses, and license numbers of all individuals who have successfully completed this course to requested agencies and the Missouri State Board of Nursing within 60 days.
4. A copy of the final record shall be provided to the licensed practical nurse participant.
5. A certificate documenting the successful completion of the Intravenous Fluid Therapy Course, which is approved by the Missouri State Board of Nursing, will be awarded.

J. Course topics

1. Unit I - Introduction
2. Unit II - Documentation
3. Unit III - Anatomy and Physiology as Applied to Intravenous Therapy
4. Unit IV - Fundamental Aspects of Fluid and Electrolyte Balance
5. Unit V - Recognition and Prevention of IV Therapy-Related Complications
6. Unit VI - Administration of Intravenous Fluid Therapy
7. Unit VII - Intravenous Fluid Therapy Maintenance
8. Unit VIII - Pharmacological Considerations
9. Unit IX - Blood Transfusion Therapy
10. Unit X - Total Parenteral Nutrition and Nursing Practice

III. Understanding the Legal Basis for Nursing Duties (II-3)

A. Missouri Nursing Practice Act - designed to provide legal coverage to perform intravenous therapy (HO I)

I. Scope of IV fluid treatment by licensed practical nurse:

335.017. Intravenous fluid treatment - selected acts, who may perform, definitions and limitations. One of the selected acts

which may be performed by persons licensed under the provisions of this chapter as licensed practical nurses is the administration of intravenous fluid treatment. The board shall have the authority to adopt and revise rules and regulations which limit and define the scope of intravenous fluid treatment which may be performed by licensed practical nurses. Nothing herein shall be construed as prohibiting administration of intravenous fluid treatment by registered professional nurses. The board shall submit emergency rules to the Secretary of State to implement the provisions of this section within thirty days of the effective date of this act and the board shall act promptly on applications of organizations requesting approval of their course of instruction.

2. Functions of intravenous therapy performed by licensed practical nurses:

The administration of intravenous fluid treatment may be performed only by licensed practical nurses who have been educated in such procedures in a course of instruction approved by the board.

3. Joint statement:

Authoritative statement or document issued by a state nurses' association in conjunction with some other significant health organizations and represents consensus on specific therapeutic measures in the area of nursing practice.

B. Rule 4 CSR 200-6.010 (Intravenous Fluid Treatment Administration) (HO 2)

1. Effective: April 12, 1984 - Revised November 11, 1985.

2. Includes:

- a. Definitions
- b. Scope of Responsibility
- c. Limitations
- d. Program Application Procedures
- e. Curriculum standards
- f. Course Guidelines

3. As the rule is continually re-evaluated by the Board of Nursing, there may be further interpretations of the rule, additions and/or deletions. (HO 3)

C. Institutional policies - role clarification (II-5)

D. Failure to apply knowledge (negligence)

1. Failure to use prudent judgment
2. Administering drugs if patient states an allergy

3. Infections due to lack of adherence to aseptic technique
 4. Using defective equipment
 5. Inadequate documentation
- E. Principles to assist in avoiding legal actions (malpractice) (II-6)
1. Stay within bounds of statutory legal requirements.
 2. Function within degree of knowledge and skill.
 3. Intervene correctly in adverse reactions.
 - a. Notify physician.
 - b. Document.
 4. Maintain good rapport with patient and family.

IV. Summary and Conclusion

- A. Entry level skills/requirements
- B. Introduction to the intravenous fluid therapy course
- C. Understanding the legal basis for nursing duties

LESSON PLAN: 1
COURSE TITLE: INTRAVENOUS FLUID THERAPY
UNIT 1 INTRODUCTION

INTERACTION ITEMS:

1. What is the purpose of this course?
2. What would or could be some personal applications of the course objectives?
3. Why is it important to have legal definitions for the LPN's role in the administration of IV fluid treatment?
4. What are the boundaries within which LPNs work?
5. What will your role be in your place of employment after becoming IV therapy certified?
6. What would you do to avoid legal action if your patient had an adverse reaction to the administration of IV fluid therapy?

CLASSROOM, LABORATORY, OR OTHER ACTIVITIES:

1. Administer pretests. Assignment sheets included in this lesson provide a bank of test questions covering anatomy and physiology (AS 1), pharmacology (AS 2), and asepsis (AS 3). Use them as suggested topics, or in their entirety as desired.
2. Review course syllabus and discuss personal interpretations of the course objectives.
3. Tour classroom facilities.
4. Have each student bring a copy of her or his institutional policy regarding IV therapy for review purposes.

LESSON PLAN: 1
COURSE TITLE: INTRAVENOUS FLUID THERAPY
UNIT 1 INTRODUCTION

EVALUATION ITEMS:

For each of the following, write "T" if the statement is true, or "F" if it is false.

- ☐ 1. The purpose of the IV Fluid Therapy Course shall be to prepare LPNs to perform unlimited IV fluid therapy.
- ☐ 2. The IV Fluid Therapy Course teaches LPNs in accordance with the American Hospital Association as recommended to the Missouri League of Nursing.
- ☐ 3. Insertion and maintenance of heparin locks cannot be performed by an IV therapy certified LPN.
- ☐ 4. It is important to know the relationship between IV fluid administration and the body's homeostatic and regulatory functions.
- ☐ 5. After completion of the course, IV certified LPNs may initiate transfusions of blood and blood components.
- ☐ 6. The venipuncture procedure involves only the venipuncture and anchoring of devices.
- ☐ 7. According to the Missouri Nursing Practice Act, after completing an approved course, the LPN may initiate an IV with saline and proceed to administer the prescribed units of blood.
- ☐ 8. The IV therapy certified LPN may change IV tubing and dressings as outlined in the institutional policy.
- ☐ 9. Only the RN may calculate the rate of IV fluid infusions.
- ☐ 10. The LPN may add premixed medicants via piggyback to existing primary lines, but may not routinely administer IV push drugs.
- ☐ 11. All IV functions and duties performed by the LPN are under the direction of an RN or a physician.
- ☐ 12. Administration of intravenous fluid treatment is the therapeutic infusion and/or injection of substances through the venous system.
- ☐ 13. Since the passage of the law and since the Board of Nursing has defined the scope of practice for the licensed practical nurse relative to intravenous fluid administration, the health care facilities must include a scope of responsibility for provision of IV therapy in their governing policies.

- ___14. Hospital policies include, but are not limited to, a definition of IV therapy, who initiates and administers IV push medications, procedures for maintaining existing lines, and charting format.
- ___15. Health care agencies (hospitals, nursing homes, etc.) may place more stringent regulations for the LPN than is outlined in CSR 200-6.010.
- ___16. Before administering IV therapy, there must be a valid order written by a licensed physician which includes drugs, dosage, route, and rate.
- ___17. The licensed practical nurse may avoid legal action if he/she intervenes correctly in adverse reactions by notifying supervisor and/or physician and properly documents events.
- ___18. Failure to apply knowledge to IV therapy administration constitutes negligence.
- ___19. Establishing a good rapport with the patient and family has no relationship to the likelihood of the patient charging malpractice.

LESSON PLAN: I
COURSE TITLE: INTRAVENOUS FLUID THERAPY
UNIT I INTRODUCTION

ANSWERS TO EVALUATION ITEMS:

1. F
2. F
3. F
4. T
5. F
6. F
7. F
8. T
9. F
10. T
11. T
12. T
13. T
14. T
15. T
16. T
17. T
18. T
19. F



HO 1

State of Missouri

John Ashcroft, Governor

Department of Economic Development
Division of Professional Registration

Carl M. Koupal, Jr., Director

State Board of Nursing
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Florence McGuire, R.N., M.S.N.
Executive Director

**STATE OF MISSOURI
NURSING PRACTICE ACT**

**MISSOURI STATUTES
CHAPTER 335
NURSES**

Section 335.017. Intravenous fluid treatment-selected acts, who may perform, definitions and limitations.

-One of the selected acts which may be performed by persons licensed under the provisions of this chapter as licensed practical nurses in the administration of intravenous fluid treatment. The administration of intravenous fluid treatment may be performed only by licensed practical nurses who have been instructed and trained in such procedures in a course of instruction approved by the board. The board shall have the authority to adopt and revise rules and regulations which limit and define the scope of intravenous fluid treatment which may be performed by licensed practical nurses. Nothing herein shall be construed as prohibiting administration of intravenous fluid treatment by registered professional nurses. The board shall submit emergency rules to the secretary of state to implement the provisions of this section within thirty days of the effective date of this act and the board shall act promptly on applications of organizations requesting approval of their course of instruction.

CSR 200-6.010INTRAVENOUS FLUID TREATMENT ADMINISTRATIONLPN/IV RULE

(1) Definitions:

- (A) Administration of Intravenous Fluid Treatment is the therapeutic infusion and/or injection of substances through the venous system.
- (B) Administration is the comprehensive activity which includes, but is not limited to: observing, initiating, monitoring, discontinuing, maintaining, regulating, adjusting, documentation; and assessing, diagnosing, planning, intervening and evaluation.
- (C) Intravenous Fluid Treatment Administration is the responsibility of the registered professional nurse, as ordered by an individual licensed in the State of Missouri to prescribe medications and treatments. The registered professional nurse may delegate selected activities associated with the administration of intravenous therapy. The registered nurse may delegate certain of the activities to experienced, qualified, appropriately educated licensed practical nurses in keeping with the registered nurse's professional judgement and standards that are established within the agency providing the intravenous therapy service.
- (D) "Under the direction of a registered professional nurse" means that the registered professional nurse may delegate intravenous therapy functions to licensed practical nurses who have passed an approved course. The registered professional nurse does not necessarily have to be on the premises in order for the licensed practical nurse to perform the delegated functions.

- (2) Upon completion of a generic practical nursing program approved by the State Board of Nursing, an LPN may observe and monitor intravenous fluid treatment, maintain the calculated flow rate of intravenous infusions, discontinue, report and document observations and procedures performed.

- (3) In addition to functions identified in (2), licensed practical nurses who have satisfactorily completed an approved course of instruction may perform the following functions and duties relating to the administration of intravenous fluid treatment under the direction of a registered professional nurse.

- (A) Calculating the rate of intravenous fluid infusions.
- (B) Adding parenteral solutions to existing patent intravenous lines.
- (C) Changing intravenous tubings and dressings.
- (D) Initiating intravenous fluid treatment only peripherally and only with devices which do not exceed three (3) inches in length.

- (E) Adding, to existing patent intravenous lines, designated premixed medications, via intravenous piggy-back, either by continuous or intermittent methods.
 - (F) Maintaining the patency of Heparin Locks.
- (4) Licensed practical nurses MAY NOT perform the following functions or duties related to the administration of intravenous fluid treatments:
- (A) INITIATING TPN FLUIDS.
 - (B) INITIATING OR ADDING ANTI-NEOPLASTIC AGENTS.
 - (C) INITIATING OR ADDING BLOOD/BLOOD COMPONENTS.
 - (D) ADMINISTERING DRUGS IV PUSH. (Life-threatening circumstances may necessitate the administration of IV push medications by experienced/qualified licensed practical nurses under the direction of a registered professional nurse or physician.)
- (5) Application Procedures for Intravenous Fluid Treatment Program:
- (A) Purpose of Approval: To establish basic preparation for licensed practical nurses to perform the administration of intravenous fluid treatments within the scope authorized by the Rules and Regulations.
 - (B) Types of Programs Approved.
 - 1. Postgraduate programs offered by colleges and vocational-technical schools.
 - 2. Programs offered by health care facilities which provide intravenous therapy.
 - (C) Procedure for Initial Approval.
 - 1. An institution desiring to obtain approval for an intravenous fluid treatment program shall submit a proposal to the State Board of Nursing. The proposal shall be written by and bear the signature of a registered professional nurse who is currently licensed to practice as a registered nurse in Missouri.
 - 2. An Institution submitting a proposal for initial approval shall include in the proposal any information it deems pertinent, however, the proposal shall contain the following:
 - A. Objectives of the Program. Terminal objectives shall identify behaviors expected of the graduates at the completion of the program.
 - B. Qualifications of the Faculty of the Program.
 - C. Curriculum.
 - D. Maximum Faculty-Student Ratio in Clinical Component.

- E. Number of hours of classroom instruction and number of hours of clinical practice under the supervision of a registered professional nurse designated by the sponsoring agency.
- F. Description of the training facilities which will be used by the programs. The description shall be sufficiently detailed to establish that the training facilities will meet the standards required of the training facilities under the Rules and Regulations.
- G. Mechanism through which the institution will determine that LPN's seeking admission to the program meet the admission requirements established by the Rules and Regulations.
- H. Methods of student evaluation which will be used.

(D) An institution which has previously obtained approval shall comply with any subsequent changes in this rule beginning with the first class which begins the course following the effective date of the rule change. The institution shall submit a report to the State Board of Nursing indicating the manner in which it will comply with the change in the rule. After the State Board of Nursing reviews the report, if the board approves the manner in which the institution will comply, the board shall notify the institution of its approval. If, after review, the board determines that the manner in which the institution will comply is not adequate, the board shall notify the institution of the inadequacies. Following such notification, re-approval of the program will be required before the institution begins its next class.

(E) Program Changes Requiring Board Notification:

- 1. All changes in information required to be provided in the initial proposal require board approval. Requests for approval of such changes shall be submitted to the board in writing three (3) weeks prior to the next regularly scheduled board meeting and shall be approved by the board before implementation. Changes in the faculty of the program do not require board approval. The program shall notify the board in writing of faculty changes.

(6) Standards for Curriculum:

- (A) The purpose of the Intravenous Fluid Treatment Program shall be to prepare licensed practical nurses to perform limited intravenous fluid treatment. The program shall be designed to teach knowledge, skills, and competencies in administration of intravenous therapy which will qualify licensed practical nurses to perform this procedure safely.
- (B) The course shall consist of at least forty (40) classroom hours of instruction and a minimum of eight (8) hours of clinical practice under the supervision of a registered professional nurse designated by the sponsoring agency, including a final written and practical examination.
- (C) Course Pre-requisites - The licensed practical nurse shall meet the following pre-requisites prior to enrolling in the course:

1. Current licensure as a licensed practical nurse in the State of Missouri.
2. Have taken a pre-test in pharmacology, anatomy, physiology and asepsis to be used as a diagnostic tool to determine level of knowledge.

(D) Faculty Qualifications:

1. Each faculty member shall be currently licensed to practice as a registered professional nurse in the State of Missouri.
2. Each faculty member shall have a minimum of three (3) years clinical experience immediately prior to his or her appointment.
3. Non-nurse lecturers shall have professional preparation and qualifications for the specific subject area in which they are involved.

(E) Training Facility:

1. All classrooms shall contain sufficient space, equipment and teaching aids to meet the course objectives.
2. The facility in which clinical practice and the final practicum will be conducted shall allow students and instructors access to the intravenous therapy equipment and access to intravenous therapy recipients and to the pertinent records for purpose of documentation.
3. There shall be signed written agreement between the sponsoring agency and a cooperating health care facility which specifies the roles, responsibilities and liabilities of each party. This written agreement will not be required if the only health care facility to be used is also the sponsoring agency.

(F) Testing:

1. The student shall achieve a passing grade on a final exam which shall consist of written and clinical components.
2. The clinical exam shall include evaluation of the achievement of the clinical objectives of the course.
3. The instructor shall complete the final records and the record sheet shall include competencies and scores.

(G) Records

1. The agency conducting the intravenous course shall maintain the records of the individuals for a period of at least five (5) years and shall, within sixty (60) days, submit to the Missouri State Board of Nursing the names, addresses, dates of completion and license numbers of all individuals who have successfully completed the program.
2. A copy of the final record shall be provided to the licensed practical nurse.

3. The agency conducting the intravenous therapy course shall award a certificate documenting successful completion of the approved program by the Missouri State Board of Nursing to the licensed practical nurse, upon successful completion of the course.

(7) Intravenous Fluid Treatment Administration Course Guidelines - An Intravenous Fluid Treatment Administration Course Shall Have the Following Components:

- (A) Review of the Missouri Nursing Practice Act, the current Intravenous Therapy Rule and the Policies and Procedures of the clinical agency where practical experience is received.
- (B) Structure of the circulatory system including site and function of the veins used for venipuncture.
- (C) Relationship between intravenous fluid treatment administration and the body's hemostatic and regulatory functions, with attention to the clinical manifestations of fluid and electrolyte imbalance and cellular physiology.
- (D) Principles of infection control in intravenous fluid treatment administration.
- (E) Identification of various types of equipment used in intravenous fluid treatment administration with content related to criteria for use of each and means of trouble-shooting for malfunctions.
- (F) Principles of compatibility and incompatibility of drugs and solutions.
- (G) Nursing management of special intravenous fluid treatment administration procedures that are commonly used in the clinical setting, such as heparin lock.
- (H) Procedures for venipuncture, including psychological preparation, site selections, skin preparation, puncture, anchor, collection of equipment and documentation.
- (I) Maintenance of intravenous fluid treatment administration system: discontinuing intravenous fluid treatment administration, monitoring infusion, changing containers and tubing, care of site, etc.
- (J) Nursing management of the patient receiving drug therapy, including actions, interactions, adverse reactions, methods of administration and assessment.
- (K) Signs and symptoms of local and systemic complications in the delivery of fluids and medications and the preventive and treatment measures for those complications.
- (L) Calculations of fluid and drug administration rates.

Auth: Section 335.017, RSMo (1986). Emergency Rule Filed Dec. 16, 1983, Effective Dec. 26, 1983, Expired April 24, 1984. Original Rule Filed Dec. 16, 1984, Effective April 12, 1985. Amended: Filed May 24, 1985, Effective Nov. 11, 1985. Amended: Filed Aug. 5, 1987. Effective November 12, 1987.

LPN/IV THERAPY RULE

BOARD CLARIFICATIONS/INTERPRETATIONS/DECISIONS

REQUEST Whether or not Licensed Practical Nurses can change cassetts on PCA Morphine Infusion Pumps and attach them to existing Subclavians, Hickman, or Mediport Tubings.

RESPONSE JUNE, 1987 Licensed Pracitcal Nurses who are IV Certified, in the process of administering pre-mixed Patient Controlled Infusion Pump Pain Control Medications, may change cassetts of the Patient Controlled Infusion Pump.

REQUEST Whether or not Licensed Practical Nurses can administer a Bolus Dose of Morphine by pushing a button on the pump that is already programmed to give a specific dose and cannot be repeated within a given time.

RESPONSE JUNE, 1987 Administration of IV Pain Medications, per pre-set Infusion Pumps, is within the scope of nursing practice of Licensed Practical Nurses who are IV Certified as stated within 4 CSR 200-6.010 (3) (E).

BOARD CLARIFICATION APRIL, 1987 IV Approved Licensed Practical Nurses may add to Existing Patent Intravenous Lines, designated Premixed medications via IV Piggyback. This does not allow for mixing solutions or adding a medication to an existing solution.

BOARD CLARIFICATION APRIL, 1987 A Licensed Practical Nurse who has had the Dialysis Course, which is approved by the Department of Health, may Initiate Dialysis. It is not necessary for that individual to have had a Board Approved IV Course. The Board does suggest, however, that the Licensed Practical Nurse sign his/her name as LPN/Dialysis Technician to clarify that individual's position.

BOARD CLARIFICATION APRIL, 1986 Existing Patent Intravenous Lines Include Central Venous Lines.

BOARD CLARIFICATION APRIL, 1986 Maintaining the Patency of Heparin Locks include maintaining the Patency of devices such as the Hickman-Bovac Catheter and the Multi-Lumen Central Venous Catheter with Heparin.

BOARD CLARIFICATION APRIL, 1986 Initiating TPN is restricted, but the IV Approved LPN may hang subsequent bags of TPN.

LPN/IV THERAPY RULE
BOARD CLARIFICATIONS/INTERPRETATIONS/DECISIONS
PAGE TWO (2) CON'T

BOARD DECISION APRIL, 1986 The Board Approved the following options for individuals who are IV Approved in another state wanting to transfer the Certification to Missouri:

Contact a Board Approved LPN/IV Therapy Course in Missouri and ask them to evaluate the curriculum of the course taken in another state. They may:

1. Accept the Course taken in that state and issue a certificate.
2. Accept a portion of the course taken in that state and only require the individual to complete what is not accepted and issue a certificate.
3. Accept the individual to take the complete course and issue a certificate upon successful completion of the course.
4. The decision regarding acceptance of a transfer course or acceptance into an approved course is that of the institution providing the course.

ASSIGNMENT SHEET 1: ANATOMY AND PHYSIOLOGY PRETEST

True/False: For each of the following, write "T" if the statement is true, or "F" if the statement is false in the space provided.

- ___ 1. Peripheral veins are located on the body surface or in the extremities.
- ___ 2. Electrolytes cannot move through cell membranes.
- ___ 3. Deep vein thromboses (clots) are more likely to embolize than those in superficial veins.
- ___ 4. Patients with liver disease have an increased tendency to form blood clots.
- ___ 5. Patients who are malnourished have increased susceptibility to infection.
- ___ 6. Disinfectants are too irritating to be used on the skin.
- ___ 7. Isotonic fluids are similar in concentration to plasma.

Multiple Choice: For each of the following, circle the correct answer.

- 8. Veins differ in structure from arteries because they:
 - a. Are not elastic
 - b. Have no muscle fibers
 - c. Contain valves
 - d. Have smaller lumens
- 9. All veins carry unoxygenated blood except the:
 - a. Pulmonary veins
 - b. Superior vena cava
 - c. Inferior vena cava
 - d. Hepatic vein
- 10. Blood is moved up the veins in the lower extremity by:
 - 1. Force of the systolic pressure
 - 2. Action of skeletal muscles
 - 3. Force of the diastolic pressure
 - 4. Action of one-way valves
 - a. 1,2
 - b. 1,3
 - c. 2,4
 - d. 1,4

11. A characteristic of veins is:
- The walls are thicker and stronger than arteries
 - They have many branches and interconnections
 - They have no muscle layer in the walls
 - They have no sensory nerve endings
12. When a blood vessel is injured, the first defensive response is:
- Platelets cluster at the site of injury, to seal it
 - Blood flow is shunted to collateral vessels, to minimize hemorrhage
 - Additional blood cells are released from the bone marrow
 - Lymphocytes form antibodies to the injurious agent
13. The chief function of the circulatory system is:
- Transportation
 - Protection
 - Coordination
 - Heat regulation
14. The exchange of oxygen and nutrients for carbon dioxide and waste products takes place in the:
- Arteries
 - Arterioles
 - Capillaries
 - Veins
15. The straw-colored fluid part of the blood is called:
- Lymph
 - Plasma
 - Tissue fluid
 - Exudate
16. The formation of a clot in a vein, accompanied by inflammation is called:
- Thrombophlebitis
 - Infiltration
 - Varicosity
 - Lymphadenitis
17. Symptoms of an inflammation include which of the following?
- Heat and redness in the area
 - Swelling of the area
 - Hemorrhage into surrounding tissue
 - Pain in the area
- 1,3
 - 1,2,3
 - 1,3,4
 - 1,2,4

18. The flow of blood through the veins is directed by:
- a. Rhythmic contractions of the vein walls
 - b. Gravity pressure
 - c. The force of the heart's contractions
 - d. Valves within the veins
19. All the following are indicative of thrombophlebitis except:
- a. Pain along a vein
 - b. Localized redness
 - c. Localized edema
 - d. Area cool to touch
20. A thrombus is defined as :
- a. A moving clot of blood
 - b. A straw-colored clot
 - c. A stationary clot
 - d. An outpouching of an artery
21. Embolus is defined as:
- a. The earliest form of a blood clot
 - b. A fully-formed, stable clot
 - c. A free-floating fragment of clot
 - d. A clotting factor formed in the liver
22. What are varicosities?
- a. Superficial hemorrhages from capillaries
 - b. Dilated, tortuous veins with sluggish blood flow
 - c. Easily movable veins with little supporting tissue
 - d. Small pinpoint hemorrhages beneath the skin surface
23. Sloughing is defined as:
- a. Loss of tissue as a result of injury
 - b. Cutting away of necrotic tissue
 - c. A horny thickening of the epidermis
 - d. Severe itching
24. The blood cells that initiate the clotting process are:
- a. Leukocytes
 - b. Platelets
 - c. Erythrocytes
 - d. Neutrophils

25. Venous blood returns to which part of the heart?
- Right atrium
 - Left atrium
 - Right ventricle
 - Left ventricle
26. Muscles in the walls of blood vessels that control the diameter of the vessel are:
- Branching
 - Voluntary
 - Striated
 - Smooth
27. The body is composed mostly of:
- Muscle
 - Epithelium
 - Bone
 - Water
28. Charged chemical particles that are dissolved in body fluids are:
- Electrolytes
 - Acids
 - Bases
 - Salts
29. The degree of acidity or alkalinity of a substance is expressed as:
- Osmolality
 - Osmolarity
 - pH
 - Partial pressure
30. Bicarbonate, plasma proteins, and hemoglobin are parts of which acid-base buffer system?
- Blood
 - Lungs
 - Cells
 - Kidneys
31. Osmotic movement across a semipermeable membrane means:
- Water moves from the less concentrated solution to the more concentrated solution.
 - Water moves from the more concentrated solution to the less concentrated solution.
 - Electrolytes move from the area of higher concentration to the area of lower concentration.
 - Electrolytes move from the less concentrated area to the more concentrated area.

32. The outermost layer of the skin is called the:
- Melanin
 - Dermis
 - Epidermis
 - Subcutaneum
33. Functions of the skin include which of the following?
1. Temperature regulation
 2. Protection against infection
 3. Maintaining fluid balance
 4. Sensation
- 1,2,4
 - 1,3,4
 - 2,3,4
 - 1,2,3,4
34. Pulmonary edema is due to failure of which part of the heart?
- Right atrium
 - Left atrium
 - Right ventricle
 - Left ventricle
35. Which age group has the highest proportion of body water?
- Infants
 - Children
 - Middle-aged
 - Elderly
36. Which age group has the lowest proportion of body water?
- Infants
 - Children
 - Middle-aged
 - Elderly
37. All of the following are signs of dehydration except:
- Fever, in absence of infection
 - Dry mucous membranes
 - Irregular pulse
 - Urine output is less than 500 cc in 24 hours
38. The word dorsal describes:
- Normal posture
 - Those body parts farthest from the heart
 - The internal organs
 - The back of an organ or the body

39. The functioning unit of the entire body is the:
- Blood
 - Nerves
 - Cell
 - Oxygen
40. The body makes continuous adjustments to keep the internal environment almost constantly of the same chemical composition. This process is referred to as:
- Metabolism
 - Digestion
 - Homeostasis
 - Protection
41. "Tissue fluid" can be found:
- In the cytoplasm of the cell
 - Only in the blood stream
 - Around each cell
 - In all body fluids
42. The life of the cell depends on the tissue fluid because:
- Food substances are absorbed from it
 - Foods are broken down for cell use here
 - Bacteria-fighting forces are located here
 - Wastes are discharged into it
- 1,4
 - 2,3,4
 - 1
 - 1,2,3,4
43. The semipermeable cell membrane makes it possible for the cell to:
- Filter out invading bacteria
 - Select the food materials it needs and eliminate others
 - Allow food and oxygen to enter and waste products to leave
 - Control the size of the cell pores
44. The role of the skeletal system in homeostasis is noted when the bones:
- Manufacture calcium in the absence of adequate nutrition
 - Give up calcium to keep the blood calcium level constant
 - Remove calcium from other cells to strengthen the skeleton
 - Leave needed calcium in the blood stream instead of using it

45. The solid part of the blood consists of
1. Proteins
 2. Gamma globulin
 3. Red and white blood cells
 4. Platelets
- a. 1,2,3,4
b. 3
c. 2,3
d. 1,2,4
46. The oxygen-carrying part of the blood is contained in the:
- a. Red blood cells
 - b. Monocytes
 - c. Plasma
 - d. Platelets
47. A normal red blood count would vary from:
- a. 5,000 to 10,000 cells per cubic millimeter
 - b. 4.5 to 5.5 million cells per cubic millimeter
 - c. 1 to 2 million cells of each type per cubic millimeter
 - d. 7 to 10 million cells per cubic millimeter
48. A normal white blood count would average:
- a. 5,000 to 9,000 cells per cubic millimeter
 - b. 4.5 to 5.5 million cells per cubic millimeter
 - c. 1 to 2 million cells of each type per cubic millimeter
 - d. 7 to 10 million cells per cubic millimeter
49. Blood is forced out of the left ventricle and into the blood vessels in the following pattern:
- a. Arteries, veins, capillaries
 - b. Arteries, capillaries, veins
 - c. Veins, capillaries, arteries
 - d. Capillaries, arteries, veins
50. The inside of the heart is divided into:
- a. Two parts
 - b. Three parts
 - c. Four parts
 - d. Equal parts
51. Blood that flows into the right side of the heart is going to the:
- a. Brain
 - b. Lungs
 - c. Parts of the body
 - d. Heart

52. The blood that is pumped out of the left ventricle contains:
- A full supply of oxygen
 - Impurities that must be removed by the liver
 - A high percent of carbon dioxide
 - All the wastes to be delivered to the organs of excretion
53. Changes in the blood vessels affect the blood pressure. It is true that:
- The size of the blood vessel depends on the force of the heart beat
 - Constricted blood vessels increase blood pressure
 - Relaxed blood vessels decrease blood pressure
 - All body activities cause a change in the blood vessels
- 1,2,3,4
 - 1,4
 - 2,3
 - 1
54. The valve that separates the top from the bottom section of the right side of the heart opens:
- Into the pulmonary artery
 - From the auricle into the ventricle
 - From the ventricle into the auricle
 - To allow blood to enter from the inferior vena cava
55. The thickest part of the heart muscle is the:
- Valve
 - Ventricle
 - Right auricle
 - Left ventricle

Matching: Match the following terms and descriptions.

- | | | |
|-----------|--|----------------|
| _____ 56. | Of, on, or near the back | a. Valve |
| _____ 57. | Abnormal accumulation of fluid in tissues | b. Lumen |
| _____ 58. | Lying near the surface | c. Tortuous |
| _____ 59. | Inside opening of a vessel | d. Edema |
| _____ 60. | Noticeable bulge near where veins branch out | e. Dorsal |
| _____ 61. | Having irregular bends or turns | f. Superficial |

ASSIGNMENT SHEET 2: PHARMACOLOGY PRETEST

True/False: For each of the following, write "T" if the statement is true, or "F" if the statement is false in the space provided.

- _____ 1. The method chosen to administer a drug depends very little upon the nature of the drug, the desired effect, and condition of the patient.
- _____ 2. Systemic effect of a drug is achieved when it is absorbed into the circulation and is carried to body cells.
- _____ 3. Parenteral administration of medicants is the dispensing of oral medications.
- _____ 4. Transfusions are intravenous administrations of blood.
- _____ 5. All illegible labels must be replaced by the nurse.
- _____ 6. Stock method of storing medicines gives greater safety when administering meds.
- _____ 7. Stat meds are to be given as soon as possible.
- _____ 8. When dealing with meds, the nurse should be familiar with standard medical abbreviations.
- _____ 9. Recognition and adherence to expiration dates are necessary for safety drug administration.
- _____ 10. When preparing medications you need only to read labels once.
- _____ 11. There is no logical, ethical, or legal reason why you cannot use medications prepared for another person.
- _____ 12. Unlabeled containers are safe to use meds from, as long as you know the med.
- _____ 13. Ultra-lente insulin is the only form of insulin that can be given IV.

Matching: Match the following terms with their correct definitions.

- | | | | |
|-----------|-----------------------------|----|--|
| _____ 14. | Toxic dose | a. | The first dose of drug given--may be more than later doses |
| _____ 15. | Cumulative effect | b. | The effects of one drug counteract the effects of another |
| _____ 16. | Side effect | c. | The amount of drug that is given on a regular basis to continue the therapeutic action |
| _____ 17. | Therapeutic incompatibility | d. | The amount of drug which will cause harmful effects |
| _____ 18. | Initial dose | e. | Pre-existing condition which makes use of a drug inadvisable |
| _____ 19. | Serum level | f. | Additional actions of a drug other than the purpose for which it is ordered |
| _____ 20. | Synergistic effect | g. | The amount of drug that is absorbed into the blood |
| _____ 21. | Maintenance dose | h. | Two or more drugs combined have a greater therapeutic action |
| _____ 22. | Contraindications | i. | Result of storage of drug in tissues, or delayed breakdown of drug |

Multiple Choice: For each of the following, circle the correct answer.

23. Which route of medication yields the fastest effect?

- a. PO
- b. IM
- c. Subcutaneous
- d. IV

24. Which medication route is the slowest acting?
- PO
 - IM
 - Subcutaneous
 - IV
25. A drug that destroys microorganisms is classified as an:
- Antitoxin
 - Antibiotic
 - Antitussive
 - Antipyretic
26. Diuretics are used in the treatment of hypertension because they:
- Reduce intravascular pressure by decreasing blood volume
 - Lower intravascular pressure by vasodilatation
 - Reduce pressure by slowing the heart rate
 - Improve circulation by decreasing myocardial oxygen demand
27. A common side effect of many diuretics is:
- Potassium loss
 - Sodium retention
 - Platelet suppression
 - Capillary fragility
28. Skin rash, hives, itching, and swelling of mucous membranes are signs of:
- Fluid overload
 - Dehydration
 - Drug toxicity
 - Allergic reaction
29. Before giving any type of digitalis preparation, you should:
- Check the patient's blood pressure.
 - Count the patient's pulse.
 - Count the patient's respiration.
 - Be sure the patient has had an EKG in the last 24 hours.
30. A drug has an idiosyncratic effect when:
- The drug is absorbed into the blood and is carried to all body cells
 - Psychological and physiological dependence occurs
 - Unusual, unpredictable, unexpected reactions occur
 - The metabolic rate increases in response to the drug

31. The slanted portion of the tip of a needle is the:
- a. Flange
 - b. Lumen
 - c. Bevel
 - d. Hub
32. You are attempting to mix two drugs in a syringe. As you draw up the second drug, you notice white solid particles forming in the syringe. This is an example of:
- a. Chemical incompatibility
 - b. Bacterial contamination
 - c. Deterioration due to long storage
 - d. Incomplete dissolving of the first drug
33. What is the appropriate action for the above situation (pretest item 32)?
- a. Roll the syringe between your palms to warm and mix the drugs.
 - b. Change to a larger needle so you can inject the mixture.
 - c. Draw up the drugs in separate syringes and administer in two injections
 - d. Draw up additional water for injection so the drugs can completely dissolve.
34. If a patient's IV is running at 25 drops per minute through a tubing in which 15 drops equals 1 ml, how much fluid will she/he get in one (1) hour?
- a. 36 ml
 - b. 50 ml
 - c. 100 ml
 - d. 125 ml
35. The physician has ordered three liters of IV fluid to run for 24 hours. How many ml/hr will this be?
- a. 50 ml
 - b. 100 ml
 - c. 125 ml
 - d. 150 ml
36. Which of the following IV catheters is largest?
- a. 18 gauge
 - b. 20 gauge
 - c. 23 gauge
 - d. 25 gauge
37. Medications administered by which method must be soluble, sterile, and nonirritating?
- a. Parenteral
 - b. Oral
 - c. Rectal
 - d. Topical

38. SOS abbreviation means:
- a. Every morning
 - b. Bedtime
 - c. Now; STAT
 - d. One time only if necessary
39. To establish proper patient identification when giving meds:
- a. Check ID band to card or MAR
 - b. Administer if patient answers yes to name when called
 - c. Administer medication to patient in room
 - d. Ask the patient who he/she is (name)
40. Administering medication 30 minutes on either side of the designated time is considered:
- a. Too early
 - b. On time
 - c. Too late
 - d. A med error
41. Medications, blood, fluids, and electrolytes may be administered by:
- a. Intramuscular route
 - b. Subcutaneous route
 - c. Intravenous route
 - d. Topical
42. Intravenous medication may be administered continuously or intermittently by the use of:
- a. Heparin lock
 - b. Foley catheter
 - c. N/G tube
 - d. Kinking and unkinking the IV tubing
43. List the five rights of medication administration.
- a.
 - b.
 - c.
 - d.
 - e.

ASSIGNMENT SHEET 3: ASEPSIS PRETEST

True/False: For each of the following, write "T" if the statement is true, or "F" if the statement is false in the space provided..

- _____ 1. Asepsis refers to the presence of germ life.
- _____ 2. A sterile bandage is one that is free of all living organisms.
- _____ 3. An antiseptic is a chemical agent that prevents the growth of germs.
- _____ 4. A deodorant is used for cuts and wounds.
- _____ 5. Sepsis is a toxic state produced by bacteria.
- _____ 6. Infection is the invasion of the body tissues by pathogenic bacteria.
- _____ 7. Sterilization is essential in order to destroy all germs and prevent infection.
- _____ 8. Physical agents that destroy bacteria are heat, light and disinfectants.
- _____ 9. Freezing is a reliable method of sterilization.
- _____ 10. Time is of no consequence in the sterilization process.
- _____ 11. A solution containing sodium chloride is an antiseptic.
- _____ 12. Unlike bacteria, viruses grow only within living cells.
- _____ 13. Bacterial growth is inhibited by cooler temperature, such as refrigeration.
- _____ 14. Careful skin preparation with appropriate antibacterial agents will remove all bacteria from the prepped skin.

Multiple Choice: For each of the following, circle the best answer.

15. Disease germs are engulfed and destroyed in the blood or lymph by
- a. Fibrin
 - b. Platelets
 - c. Red blood cells
 - d. White blood cells

16. Bacteria may enter the body through any one of the following routes:
1. Nose
 2. Urinary tract
 3. Skin
 4. GI tract
- a. 3
b. 1,3
c. 2,3,1
d. 1,2,3,4
17. The most effective technique for preventing the spread of infection among hospitalized patients is:
- a. Handwashing
 - b. Reverse isolation
 - c. Prophylactic antibiotics
 - d. Immunologic skin tests
18. What is meant by the term "normal flora?"
- a. The external appendages of the skin, such as hair, nails, sweat glands
 - b. Microorganisms found on the skin which do not cause disease
 - c. Microorganisms living on body surfaces which can potentially cause disease
 - d. Bacteria, viruses, and fungi which are present in the hospital environment
19. A microorganism is best defined as:
- a. Any living organism
 - b. Bacteria that cause disease in the body
 - c. A plant or animal that is so small it can be seen only with a microscope
 - d. A single-celled animal that can be seen only through a magnifying lens
20. What is a nosocomial infection?
- a. A secondary infection resulting from antibiotic alteration of normal flora
 - b. Any infection that develops while a patient is in the hospital
 - c. An infection that is caused by breaks in aseptic technique
 - d. Infection by rare microorganisms that develops in immune-compromised patients
21. Disinfectants are chemicals which:
- a. Kill most types of microorganisms
 - b. Inhibit growth of microorganisms
 - c. Kill spores
 - d. Are safe to use on living tissue

22. Antiseptics are substances which:
- a. Kill disease-causing microorganisms
 - b. Inhibit growth of microorganisms
 - c. Kill bacteria, but not spores
 - d. Kill bacteria, but not fungi
23. Microorganisms that cause disease are called:
- a. Pathogens
 - b. Opportunistic
 - c. Saprophytes
 - d. Spores
24. Bacteriostatic agents are substances which:
- a. Slow down or inhibit growth of bacteria
 - b. Kill bacteria
 - c. Aid in the multiplication of helpful bacteria
 - d. Destroy all living organisms
25. Which of the following statements about handwashing is most accurate?
- a. Soaps are better cleaning agents for handwashing than detergents.
 - b. The water used for handwashing should be as hot as can be tolerated.
 - c. The longer the hands are washed, the longer they will stay clean.
 - d. The more heavily soiled the hands are, the longer they should be washed.
26. It is generally believed that microorganisms are spread in health care agencies most often by:
- a. Hands of health care workers
 - b. Equipment used by patients
 - c. Linens contaminated with drainage
 - d. Uniforms of health care workers
27. Antiseptic solutions are used to:
- a. Check the growth of bacteria on skin or mucous membranes
 - b. Destroy bacteria on instruments or hospital equipment
 - c. Disinfect water supplies or sewage
 - d. Kill bacteria in open wounds or sores
28. Pathogenic organisms are those which are:
- a. Capable of surviving in the absence of oxygen
 - b. Capable of causing disease
 - c. Harmless to body tissues
 - d. Capable of producing antibodies

LESSON PLAN:

I

COURSE TITLE:

INTRAVENOUS FLUID THERAPY

UNIT I

INTRODUCTION

Answers to Assignment Sheet 1: Anatomy and Physiology Pretest

- | | | |
|-------|-------|-------|
| 1. T | 21. c | 41. c |
| 2. F | 22. b | 42. a |
| 3. T | 23. a | 43. c |
| 4. F | 24. b | 44. b |
| 5. T | 25. a | 45. a |
| 6. T | 26. d | 46. a |
| 7. T | 27. d | 47. b |
| 8. c | 28. a | 48. a |
| 9. a | 29. c | 49. b |
| 10. c | 30. a | 50. c |
| 11. b | 31. a | 51. b |
| 12. a | 32. c | 52. a |
| 13. a | 33. d | 53. c |
| 14. c | 34. d | 54. b |
| 15. b | 35. a | 55. d |
| 16. a | 36. d | 56. e |
| 17. d | 37. c | 57. d |
| 18. d | 38. d | 58. f |
| 19. d | 39. c | 59. b |
| 20. c | 40. c | 60. a |
| | | 61. c |

Answers to Assignment Sheet 2: Pharmacology Pretest

- | | |
|-------|-------|
| 1. F | 21. c |
| 2. T | 22. e |
| 3. F | 23. d |
| 4. T | 24. a |
| 5. F | 25. b |
| 6. F | 26. a |
| 7. T | 27. a |
| 8. T | 28. d |
| 9. T | 29. b |
| 10. F | 30. c |
| 11. F | 31. c |
| 12. F | 32. a |
| 13. F | 33. c |
| 14. d | 34. c |
| 15. i | 35. c |
| 16. f | 36. a |
| 17. b | 37. a |
| 18. a | 38. d |
| 19. g | 39. a |
| 20. h | 40. b |

- 41. c
- 42. a
- 43. a. Right patient
b. Right medication
c. Right dose
d. Right time
e. Right method (route)

Answers To Assignment Sheet 3: Asepsis Pretest

- 1. F
- 2. T
- 3. T
- 4. F
- 5. T
- 6. T
- 7. T
- 8. F
- 9. F
- 10. F
- 11. F
- 12. T
- 13. T
- 14. F
- 15. d
- 16. d
- 17. a
- 18. c
- 19. c
- 20. b
- 21. a
- 22. b
- 23. a
- 24. a
- 25. d
- 26. a
- 27. a
- 28. b

LESSON PLAN: I

COURSE TITLE: INTRAVENOUS FLUID THERAPY

UNIT II DOCUMENTATION

SCOPE OF UNIT:

This unit discusses essential elements of good documentation and how these elements may be formatted. It also includes an overview of components of procedural documentation related to IV therapy.

INFORMATION TOPIC: X OR DEMONSTRATION:

DOCUMENTATION
(Lesson Title)

LESSON OBJECTIVES - THE STUDENT WILL BE ABLE TO:

1. List five elements of good documentation.
2. Accurately document the following procedures:
 - a. Initiation of IV infusion
 - b. Adding sequential container of fluid
 - c. Changing administration set tubing
 - d. Changing IV site dressing
 - e. Converting IV catheter to a heparin lock
 - f. Heparinization of heparin lock
 - g. Monitoring status of IV therapy
 - h. Patient's refusal of ordered IV therapy
 - i. Ordered discontinuation of IV therapy
 - j. Discontinuation of partially infused fluid due to change in order
 - k. Discontinuances of IV site due to infiltration
 - l. Discontinuance of IV site due to suspected phlebitis
 - m. When scheduled IV site rotation is impossible to achieve

- n. When patient arrives on division with established IV infusion
- o. Electronic flow control device utilization

SUPPLEMENTARY TEACHING/LEARNING ITEMS:

- 1. HO 1: Abbreviations Used in Documenting IV Procedures
- 2. HO 2: Examples of IV Therapy Documentation
- 3. Documentation formats brought by each student from her/his respective institution.

INFORMATIONAL ASSIGNMENT:

Bernzweig, Eli P. The Nurse's Liability For Malpractice, A Programmed Course. 3rd ed. New York: McGraw-Hill Book Company, 1981, part 7.

Nursing '80 PhotoBook Series. Managing IV Therapy. Horsham, PA: Intermed Communications, Inc., 1980, p. 43.

REFERENCES:

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Nursing '80 PhotoBook Series. Managing IV Therapy. Horsham, PA: Intermed Communications, Inc., 1980, p. 43.

INTRODUCTION:

Legally-documented care is as important as the actual care provided. If a procedure isn't documented, the courts assume it wasn't performed. Concise legible documentation provides evidence of the care administered that protects the patient, the nurse and the employing agency.

LESSON PLAN: I
COURSE TITLE: INTRAVENOUS FLUID THERAPY
UNIT II DOCUMENTATION

OUTLINE: (Key Points)

- I. Essential Elements of Good Documentation For Any Procedure (HO 1) (II-1)
 - A. Who did procedure
 - B. What was done
 - C. When it was done
 - D. Where it was done
 - E. Why was it done
- II. Documentation Format (may vary from institution to institution)
 - A. Nurses' notes
 - B. IV flow sheet
 - C. Medication administration record
 - D. Intake and output record
 - E. Kardex
 - F. Specialty forms
- III. Essential Procedural Documentation Components (HO 2)
 - A. Initiation of IV infusion
 1. Date and time
 2. Fluid
 - a. Type
 - b. Volume
 - c. Additives
 3. Cannula
 - a. Type

- b. Size
 - c. Gauge
 - d. Length
 - 4. Number of attempts
 - 5. Site
 - 6. Flow rate
 - 7. Application dressing
 - 8. Patient's tolerance of procedure
 - 9. Name of person performing procedure
 - 10. Electronic flow control device (if applicable)
 - 11. Armboard/restraint used (if applicable)
- B. Adding sequential container of fluid
 - 1. Date and time
 - 2. Fluid
 - a. Type
 - b. Volume
 - c. Additives
 - 3. Flow rate
 - 4. Fact that patency of site was ascertained
 - 5. Patient's tolerance to procedure
 - 6. Name of person performing procedure
- C. Changing administration set tubing
 - 1. Date and time
 - 2. Fact that tubing was changed
 - 3. Flow rate
 - 4. Fact that patency of site was confirmed

5. Patient's tolerance to procedure
 6. Name of person performing procedure
- D. Changing IV site dressing
1. Date and time
 2. Observation of appearance of site
 - a. Free of redness
 - b. Free of induration
 - c. Free of swelling
 - d. Free of drainage
 3. Application of antimicrobial agent
 4. Application of new sterile dressing
 5. Patient's tolerance to procedure
 6. Name of person performing procedure
- E. Converting IV catheter to a heparin lock
1. Date and time
 2. Fact that catheter was converted to a heparin lock by the aseptic attachment of a medication port (injection cap)
 3. Fact that patency of site was confirmed
 4. Observations regarding appearance of site
 5. Required flushing of heparin lock
 - a. Normal saline flush
 - (1) Volume
 - (2) Time span for injection
 - b. Instillation of heparinized saline
 - (1) Volume
 - (2) Concentration
 - (3) Time span for administration

6. Dressing application
7. Patient's tolerance to procedure
8. Name of person performing procedure
- F. Heparinization of heparin lock
 1. Date and time
 2. Normal saline flush to confirm patency
 - a. Volume
 - b. Time span for injection
 3. Instillation of heparinized saline
 - a. Volume
 - b. Concentration
 - c. Time span for administration
 4. Patient's tolerance to procedure
 5. Name of person performing procedure
- G. Monitoring status of IV therapy
 1. Infusing fluid
 - a. Type
 - b. Existing volume
 - c. Rate of flow
 2. Site
 - a. Patency confirmed
 - b. Lack of signs of local complications
 3. Patient's tolerance to therapy
 4. Name of person observing status
- H. Patient's refusal of ordered IV therapy
 1. Date and time
 2. Fact of refusal

3. Fact that need for therapy was thoroughly explained
4. Patient's continued refusal
5. Notification to physician
6. Name of person performing procedure
- I. Ordered discontinuation of IV therapy
 1. Date and time
 2. Volume of fluid discarded (if applicable)
 3. That cannula was removed in its entirety
 4. Application of pressure to achieve cessation of bleeding
 5. Appearance of discontinued site
 6. Application of dressing to discontinued site
 7. Patient's tolerance to procedure
 8. Name of person performing procedure
- J. Discontinuation of partially infused fluid due to change in order
 1. Date and time
 2. Volume of fluid discarded
 3. New fluid hung
 - a. Type
 - b. Volume
 - c. Flow rate
 4. Patient's tolerance to procedure
 5. Name of person performing procedure
- K. Discontinuation of IV site due to infiltration
 1. Date and time
 2. Cannula removed in its entirety
 3. Pressure application for cessation of bleeding
 4. Dressing application discontinued site

5. Approximate size of area of infiltration
 6. Patient's tolerance to procedure
 7. Physician notification (if applicable)
 8. Name of person performing procedure
- L. Discontinuation of IV site due to suspected phlebitis
1. Date and time
 2. Patient complaints, if any
 3. Cannula removed in its entirety
 4. Pressure application for cessation of bleeding
 5. Dressing application to discontinued site
 6. Description of site appearance
 7. Patient's tolerance to procedure
 8. Physician notification, if applicable
 9. Name of person performing procedure

NOTE: When suspected phlebitis exists, documentation should be limited to a description of the appearance of the site. It should never be diagnostic in nature, such as an entry stating "phlebitis at IV site."

- M. When scheduled IV site rotation is impossible to achieve
1. Date and time
 2. Assessment of extremities for potential site rotation
 3. Lack of potential site
 4. Appearance of existing site
 5. Name of person performing procedure
- N. When patient arrives on division with established IV infusion
1. Date and time
 2. Existing infusion
 - a. Type of fluid

- b. Current existing volume
 - c. Flow rate
- 3. Site
 - a. Location
 - b. Patency confirmed
- 4. Patient's tolerance to procedure
- 5. Name of person performing procedure
- O. Electronic flow control device utilization
 - 1. Type device
 - 2. Rate as mandated by device

IV. Documentation of IV Drug Administration

- A. Essential components of IV drug administration
 - 1. Date and time
 - 2. Name of drug
 - 3. Dose of drug
 - 4. Associated parenteral fluid, if applicable
 - a. Type
 - b. Volume
 - 5. Route of administration
 - a. Continuous infusion
 - b. IV piggyback
 - c. IV push
 - 6. Site of administration
 - 7. Time span for administration
 - 8. Patient's tolerance/response
 - a. Side effects
 - b. Adverse drug reaction

9. Name of person administering drug
- B. Documentation format - varies from institution to institution
 1. Medication administration record
 2. IV flow sheet
 3. Graphic
 4. Nurses' notes
 5. Kardex
- V. Volume Inclusion: Intake and Output Monitoring
 - A. Volume of parenteral fluids/drugs are included in intake calculations when monitoring intake and output
 - B. Documentation of intake
 1. Intake and output record sheets
 2. Graphic
 3. Nurses' notes
- VI. Summary and Conclusion
 - A. Essential elements of good documentation for any procedure
 - B. Documentation format
 - C. Essential procedural documentation components
 - D. Documentation of IV drug administration
 - E. Volume inclusion: intake and output monitoring

LESSON PLAN: I

COURSE TITLE: INTRAVENOUS FLUID THERAPY

UNIT II DOCUMENTATION

INTERACTION ITEMS:

- I. How can you determine if you have accurately documented an IV procedure?

CLASSROOM, LABORATORY, OR OTHER ACTIVITIES:

- I. Using HO I abbreviations, give students description of procedure performed and have them document on the formats brought from respective institutions.

LESSON PLAN: 1

COURSE TITLE: INTRAVENOUS FLUID THERAPY

UNIT II DOCUMENTATION

EVALUATION ITEMS:

1. List the five elements of good documentation.
 - a.
 - b.
 - c.
 - d.
 - e.
2. Accurately document the following examples:
 - a. You are adding fluid of 1000 ml N/S with new tubing to IV already in place. Site looks good.
 - b. You have started an IV with a 20 gauge Jelco Cathlon cannula that is 1½ inches and are giving 1000 ml of 5% dextrose in water at 100 ml an hour.
 - c. You are changing the gauze dressing that covers the IV insertion site. Site looks good.
 - d. You had normal saline running with a 20 gauge catheter and you changed it to a heparin lock as the doctor ordered.
 - e. You found the IV site red and the patient states "It hurts." (Has #20 cath.) (Document findings and actions taken.)

- f. You have examined the IV site that has 5% dextrose in Lactated Ringer's running in 125 mls every hour with a 20 gauge Cathlon in place. You are using an I-VAC. Site looks good.

- g. You went into the patient's room to start an IV that the physician ordered as the patient was severely dehydrated. The patient states "There's no way anyone's going to put one of those needles in me. I don't want it!" Patient remains adamant about it.

LESSON PLAN: I
COURSE TITLE: INTRAVENOUS FLUID THERAPY
UNIT II DOCUMENTATION

ANSWERS TO EVALUATION ITEMS:

1.
 - a. Who did procedure
 - b. What was done
 - c. When it was done
 - d. Where was it done
 - e. Why was it done
2. For each of the following also include documentation of date and time.
 - a. #2 1000 mls N/S added to present IV $\bar{c}$ new sol. adm. set tubing. Infusing well @ mls/hr. Site $\bar{s}$ redness, tenderness or edema. J. Doe, LPN
 - b. #20 I 1/2" Cathlon inserted (R) hand 1st attempt. #1 1000 mls 5% D/H₂O infusing well @ 100 mls/hr. Occlusive drsg applied. Site $\bar{s}$ redness, tenderness or edema. Tol. well. J. Doe, LPN
 - c. Gauze drsg rem'd from IV site. No redness, tenderness or edema. No c/o discomfort. Antiseptic and sterile drsg applied. J. Doe, LPN
 - d. N/S dc/d. Medication port applied to existing #20 I 1/2" Cathlon IV (R) hand per Dr's. order. Good blood return. Flushed $\bar{c}$ NS 1 ml over 1 min. followed by heparinized saline 1 ml over 1 min. Site $\bar{s}$ redness, tenderness, or edema. Tol. well. J. Doe, LPN
 - e. IV site to (R) hand reddened et states "it hurts." #20 I 1/2" Cathlon D.C.'d intact. Antiseptic oint et sterile Band-Aid to site. #20 I 1/2" Jelco inserted (Lt) forearm 1st attempt. Good blood return. Occlusive drsg applied. (Then if flds. infusing or med. port added, etc.) Site $\bar{s}$ redness, tenderness, or edema. Tol. well. J. Doe, LPN
 - f. IV site to (Lt) forearm $\bar{s}$ redness, tenderness or edema. 5% D/LR infusing well @ 125 mls/hr per I-VAC. J. Doe, LPN
 - g. Refuses to allow ordered IV infusion started. Attempt made to convince of need for ordered IV infusion $\bar{s}$ success. Remains adamant $\bar{c}$ refusal. Physician notified. Orders rec'd & recorded. J. Doe, LPN

Abbreviations Used in Documenting IV Procedures

cath - catheter
cm - centimeter
CV - central venous
CVP - central venous pressure
dc - discontinue
D₅/LR - dextrose 5% in lactated Ringer's
D₅/NS - dextrose 5% in normal saline
D₅/W - dextrose 5% in water
gm - gram
gtts - drops
INC - inside the needle catheter
IV - intravenous
IVPB - IV piggyback
KCL - potassium chloride
L - liter
LR - lactated Ringer's
MAR - medication administration record
mcgm - microgram
mcgtt - microdrop
mg - milligram
ml - milliliter
Na - sodium
NaCl - sodium chloride
N/S - normal saline
ONC - over-the-needle catheter
pH - measurement of acidity
RL - Ringer's lactate
TPN - total parenteral nutrition
VP - venipuncture
KO }
KVO } keep vein open
TKO }

Examples of IV Therapy Documentation

St. Somewhere Medical Center
Anywhere, Missouri

ADDRESSOGRAPH

HOUR	TREATMENTS, OBSERVATIONS AND REMARKS	SIGNATURE
	ASSESSMENT IV STATUS AT START OF SHIFT:	
0700	IV site (left hand) patent. No sign of infiltration or redness adjacent to site noted. Current IV #7 infusing at ordered rate and is on schedule with 650 ml remaining in container.	J. Joe, L.P.N.
	ASSESSMENT IV STATUS AT END OF SHIFT:	
1445	IV site (left hand) patent; 5 redness, induration and swelling. Voices no complaint of discomfort associated with IV infusion. IV #7 has infused at ordered rate throughout day. 300 ml remaining in container at this time.	J. Joe, L.P.N.
	MONITORING IV INFUSION RATE:	
1130	IV site patent. IV #7 infusing 5 difficulty at ordered rate.	J. Joe, L.P.N.
	PATIENT'S REFUSAL OF ORDERED IV THERAPY:	
1100	Refuses to have ordered IV infusion started. An attempt was made to convince of need for ordered IV infusion without success. Still firmly refuses. Physician notified. Orders received and recorded.	
	ASSESSMENT/APPEARANCE OF IV SITE:	
0900	1. DURING TUBING AND DRESSING CHANGE: IV tubing and dressing changed. IV site in left fore arm 5 redness, swelling, induration or drainage. No complaint of pain at site.	J. Joe, L.P.N.
	(CONTINUED)	

St. Somewhere Medical Center
Anywhere, Missouri

ADDRESSOGRAPH

HOUR	TREATMENTS, OBSERVATIONS AND REMARKS	SIGNATURE
	2. FOLLOWING INFILTRATION	
1100	Area of swelling (approximately 4 cm dia) adjacent to IV site due to infiltration of IV infusion, IV discontinued, pressure applied until bleeding ceased and dry sterile dressing applied to discontinued venipuncture site on left hand.	J. Joe, L.P.N.
	3. ON DAY TUBING AND DRESSING IS NOT SCHEDULED FOR CHANGE :	
1000	Visually checked area adjacent to venipuncture site dressing for sign of swelling and redness; none observed. Palpated venipuncture site through dressing; voiced no complaint of discomfort as a result of site being palpated. Dressing to site clean and intact.	J. Joe, L.P.N.
	4. WHEN SCHEDULED IV SITE ROTATION IS IMPOSSIBLE TO ACHIEVE :	
0800	Present IV site in right forearm in existence 72 hours. Extremities evaluated for potential sites for rotation of venipuncture site. No potential sites observed at this time thus rotation of site not performed. Present site in right forearm is free of redness, induration, swelling and drainage. Voiced no complaint of discomfort associated with present site.	J. Joe, L.P.N.
	(CONTINUED)	

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ADDRESSOGRAPH

HO	ADDRESSOGRAPH	HO
HOUR	TREATMENTS, OBSERVATIONS AND REMARKS	SIGNATURE
	5. UPON COMPLETION AND DISCONTINUATION OF IV INFUSION:	
1300	IV infusion #7 completed and discontinued per Dr's orders. #20 gauge Quik Catheter removed in its entirety. Pressure applied to discontinued site in left hand until bleeding stopped; dry sterile dressing applied. Discontinued site free of redness, induration, swelling and drainage.	J. Doe, L.P.N.
	6. WHEN SUSPECTED PHLEBITIS EXISTS:	
1230	Complaining of pain at IV site in left forearm. Venipuncture site dressing removed. Area of redness (approximately 2 cm diameter) noted. IV discontinued by removal of a #20 gauge 1½ inch Quik-Cath. intact; pressure applied to discontinued site until bleeding ceased followed by application of a dry sterile dressing to the discontinued site.	J. Doe, L.P.N.
CAUTION: In the event that a suspected phlebitis exists documentation should be only of a descriptive nature relating to the appearance of the site; it should NEVER be of a diagnostic nature, i.e. an entry "Phlebitis at IV site."		

HOUR	TREATMENTS, OBSERVATIONS AND REMARKS	SIGNATURE
	CENTRAL LINE TUBING AND DRESSING CHANGE:	
2030	IV tubing to right subclavian vein changed while patient was performing Valsalva's maneuver. Dressing removed from site: no apparent redness, induration, swelling nor drainage from site noted. New sterile dressing applied to site. Hyperalimentation solution (#10) infusing without difficulty at ordered rate via I-Med.	J. Joe, L.P.N.
	CENTRAL LINE PLACEMENT BY PHYSICIAN:	
2100	A #16 gauge, 9 inch, central venous catheter was inserted on the first attempt into the right subclavian vein by Dr. T. Wright. Correct placement of catheter was confirmed by portable chest X-ray. IV infusion #1 infusing at ordered rate via I-Med.	J. Joe, L.P.N.
	WHEN A PATIENT ARRIVES ON YOUR DIVISION WITH AN ESTABLISHED IV INFUSION:	
1000	Received in Room 000 with IV infusion of D5/LR (700 ml in container) infusing in left forearm. Site 5 apparent redness or swelling.	J. Joe, L.P.N.
	INSERTION OF AN IV CATHETER WITH IMMEDIATE CONVERSION TO AN INTERMITTENT INFUSION SET (HEPARIN LOCK)	
1115	#20 gauge, 1 1/2 inch, Quik-Cath, inserted in right forearm on first attempt; converted to a Heparin Lock by the attachment of a PRN adapter. Patency confirmed by the injection of	

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ADDRESSOGRAPH

HOUR	TREATMENTS, OBSERVATIONS AND REMARKS	SIGNATURE
1115	1 ml. NS IV push followed by Heparinization. C 1 ml. dilute Heparin over 1 min. Sterile dressing applied to site.	J. Joe, L.P.N.
1300	HEPARIN LOCK DRESSING CHANGE: Dressing to Heparin Lock venipuncture site changed; site free of redness, induration, swelling and drainage.	J. Joe, L.P.N.
1120	UNEVENTFUL TRANSFUSION OF WHOLE BLOOD/ BLOOD COMPONENTS* (* DENOTE SPECIFIC BLOOD COMPONENT) Pre-transfusion vital signs: TPR 98-68-18, B/P 100/68. First unit packed red blood cells started after cross-checking identification data with J. Doe, L.P.N. Infusing at 40 gtt/s/minute.	J. Jones, R.N.
1135	15 minute post-transfusion start vital signs: TPR 97-70-18, B/P 106/70. Tolerating transfusion without any signs or symptoms indicating transfusion reaction. Rate of transfusion increased to 50 gtt/s/minute. by J. Jones, R.N.	J. Joe, L.P.N.
1220	1 hour post-transfusion start vital signs: TPR 97-72-20, B/P 110/72 voicing no complaints. Packed red blood cells infusing without difficulty at 50 gtt/s/minute.	J. Joe, L.P.N.
(CONTINUED)		

ADDRESSOGRAPH

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LESSON PLAN: I
COURSE TITLE: INTRAVENOUS FLUID THERAPY
UNIT III ANATOMY AND PHYSIOLOGY AS APPLIED TO
INTRAVENOUS THERAPY

SCOPE OF UNIT:

This unit includes the anatomy and physiology of the skin, circulatory system, cardiopulmonary system, and a review of hematology as they relate to the administration of IV fluid.

INFORMATION TOPIC: X OR DEMONSTRATION:

THE SKIN
(Lesson Title)

LESSON OBJECTIVES - THE STUDENT WILL BE ABLE TO:

1. Identify four functions of the skin.
2. Identify the three layers of the skin.

SUPPLEMENTARY TEACHING/LEARNING ITEMS:

1. HO 1: The Skin
2. Brady filmstrip: "The Skin"

INFORMATIONAL ASSIGNMENT:

Plumer, Ada Lawrence. Principles and Practice of Intravenous Therapy. 4th ed. Boston: Little, Brown & Co., 1987.

Rosdahl, Caroline B. Textbook of Basic Nursing. 3rd ed. Philadelphia: J.B. Lippincott & Co., 1981, pp. 73-76.

REFERENCES:

Plumer, Ada Lawrence. Principles and Practice of Intravenous Therapy. 4th ed. Boston: Little, Brown & Co., 1987.

Rosdahl, Caroline B. Textbook of Basic Nursing. 3rd ed. Philadelphia: J.B. Lippincott & Co., 1981, pp. 73-76.

INTRODUCTION:

The skin is the body's main line of defense against infection and the first system involved in the actual venipuncture. Being familiar with the anatomy and physiology of the skin helps the nurse perform the puncture with skill and the least amount of discomfort.

LESSON PLAN: I
COURSE TITLE: INTRAVENOUS FLUID THERAPY
UNIT III ANATOMY AND PHYSIOLOGY AS APPLIED TO
INTRAVENOUS THERAPY

OUTLINE: (Key Points)

- I. Functions of the Skin (II-1)
 - A. Covers the body
 - B. Protection
 - C. Temperature regulation
 - D. Sensation
 1. From central nervous system to smooth muscle in arterial walls, to pilomotor muscle, to sweat glands
 2. To central nervous system from skin - conveys information about external environment
- II. Layers of the Skin
 - A. Epidermis
 1. Uppermost layer which forms a protective cover for the dermis
 2. Thickness varies in different parts of the body:
 - a. Thickest - palms of hand and soles of feet
 - b. Thinnest - inner surface of limbs
 3. Age influences degree of thickness (thinner in elderly)
 - B. Dermis
 1. Underlayer which is highly sensitive and vascular
 2. Contains many capillaries and thousands of nerve fibers
 3. Various types of nerve fibers located in this layer, including those which react to:
 - a. Temperature
 - b. Touch

c. Pressure

d. Pain

4. Number of nerve fibers varies in different areas of body

CAUTION: inner aspect of wrist is extremely sensitive and should be used for venipuncture only when other veins have been exhausted

C. Superficial fascia (subcutaneous areolar connective tissue) (II-2)

1. Lies below the two layers of the skin

2. Area in which the superficial veins are located

3. Varies in thickness

4. Caution: Nonadherence to aseptic technique during IV therapy can result in an infection referred to as cellulitis in this area

III. Summary and Conclusion

A. Functions of the skin

B. Layers of the skin

LESSON PLAN: I
COURSE TITLE: INTRAVENOUS FLUID THERAPY
UNIT III ANATOMY AND PHYSIOLOGY AS APPLIED TO
INTRAVENOUS THERAPY

INTERACTION ITEMS:

1. Why would it be important for a nurse administering intravenous fluids to have a knowledge of the anatomy and physiology of the skin?
2. Why is the subcutaneous fatty tissue important in the administration of IV treatment?

CLASSROOM, LABORATORY, OR OTHER ACTIVITIES:

LESSON PLAN: I
COURSE TITLE: INTRAVENOUS FLUID THERAPY
UNIT III ANATOMY AND PHYSIOLOGY AS APPLIED TO
INTRAVENOUS THERAPY

EVALUATION ITEMS:

Multiple Choice: For each of the following, circle the letter of the correct answer.

1. Which of the following statements is not a function of skin?
 - a. Invasion
 - b. Protection
 - c. Temperature regulation
 - d. Sensation
2. The three layers of skin include all of the following except:
 - a. Epidermis
 - b. Epithelial
 - c. Dermis
 - d. Subcutaneous tissue
3. The uppermost layer of skin which provides a protective cover is the:
 - a. Epidermis
 - b. Epithelial
 - c. Dermis
 - d. Subcutaneous tissue
4. The highly sensitive and vascular layer of skin is the:
 - a. Epidermis
 - b. Dermis
 - c. Subdural tissue
 - d. Subcutaneous tissue
5. The skin layer which connects the dermis to the underlying tissue and contains the majority of veins used in the administration of IV therapy is the:
 - a. Epidermis
 - b. Dermis
 - c. Mesentary
 - d. Subcutaneous tissue

LESSON PLAN: I

COURSE TITLE: INTRAVENOUS FLUID THERAPY

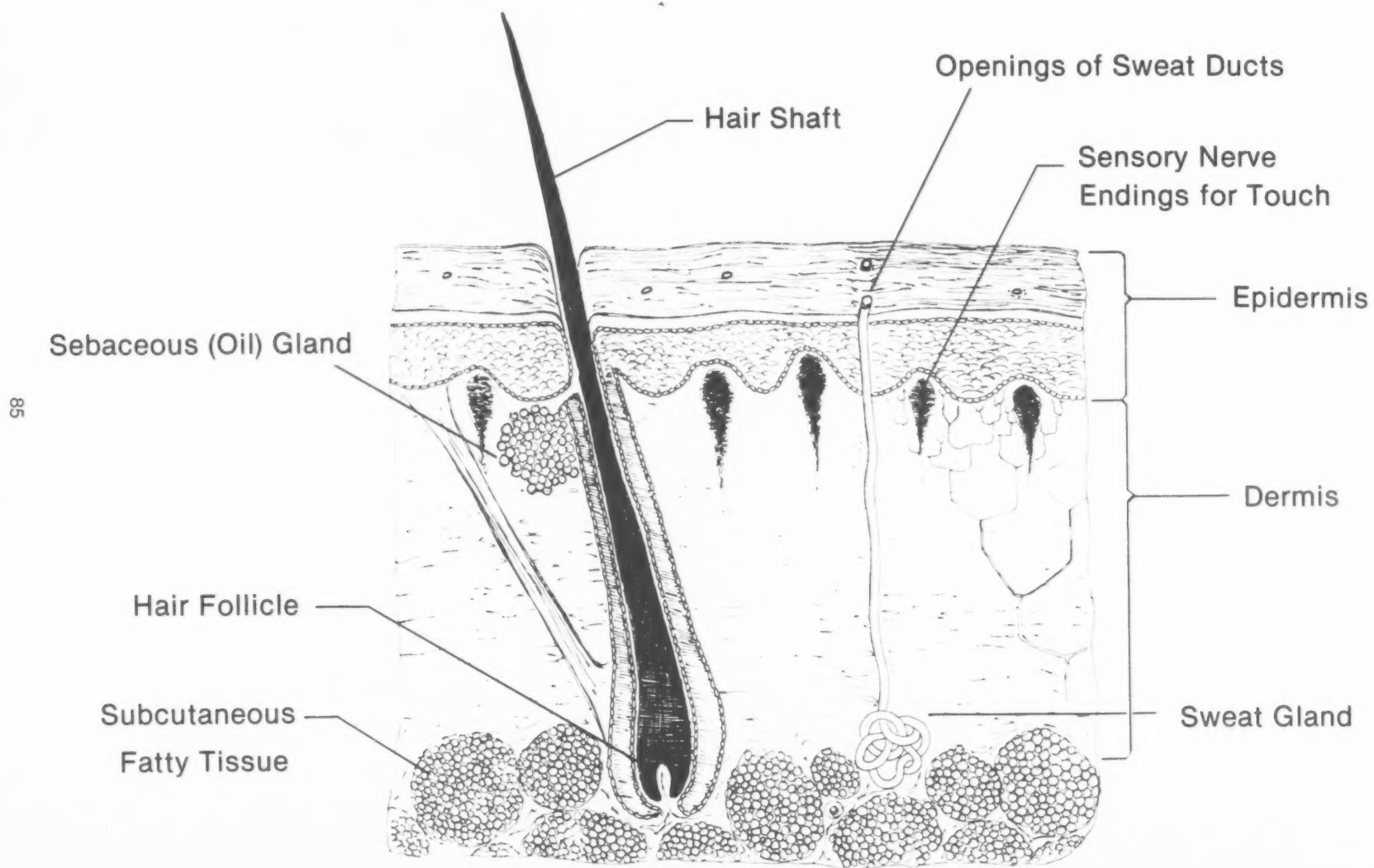
UNIT III ANATOMY AND PHYSIOLOGY AS APPLIED TO

INTRAVENOUS THERAPY

ANSWERS TO EVALUATION ITEMS:

1. a
2. b
3. a
4. b
5. d

The Skin



LESSON PLAN: 2
COURSE TITLE: INTRAVENOUS FLUID THERAPY
UNIT III ANATOMY AND PHYSIOLOGY AS APPLIED TO
INTRAVENOUS THERAPY

SCOPE OF UNIT:

This unit includes the anatomy and physiology of the skin, circulatory system, cardiopulmonary system, and a review of hematology as they relate to the administration of IV fluid.

INFORMATION TOPIC: X OR DEMONSTRATION:

THE CIRCULATORY SYSTEM
(Lesson Title)

LESSON OBJECTIVES - THE STUDENT WILL BE ABLE TO:

1. Differentiate between arteries, arterioles, veins, venules, and capillaries.
2. Locate four structures of a vein.
3. Match veins of the upper extremity and torso to location.
4. List three factors that may predispose an IV therapy patient to a vasovagal reaction.

SUPPLEMENTARY TEACHING/LEARNING ITEMS:

1. TM 1: Capillary System
2. HO 1: Blood Vessel Structure
3. HO 2: Characteristics of Arteries and Veins
4. HO 3: Major Veins of the Right Arm and Upper Torso
5. HO 4: Metacarpal Veins
6. HO 5: Central Veins of the Upper Torso

INFORMATIONAL ASSIGNMENT:

Plumer, Ada Lawrence. Principles and Practice of Intravenous Therapy. 4th ed. Boston: Little, Brown & Co., 1987.

Rosdahl, Caroline B. Textbook of Basic Nursing. 3rd ed. Philadelphia: J.B. Lippincott & Co., 1981, pp. 104-114.

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Chaffee, Ellen E. and Ivan M. Lytle. Basic Physiology and Anatomy. 4th ed. Philadelphia: J. B. Lippincott & Co., 1980, pp. 337, 362.

Galliant, Barbara. IV Therapy. Stillwater, OK: State Department of Vocational and Technical Education. Curriculum and Instructional Materials Center, 1983.

Plumer, Ada Lawrence. Principles and Practice of Intravenous Therapy. 4th ed. Boston: Little, Brown & Co., 1987.

Rosdahl, Caroline B. Textbook of Basic Nursing. 3rd ed. Philadelphia: J.B. Lippincott & Co., 1981, pp. 104-114.

INTRODUCTION:

Intravascular therapy consists of the introduction of fluids, blood, and drugs directly into the vascular system, which includes arteries, bone marrow, and veins. Veins are choice for fluid therapy due to factors of abundance, location, and accessibility. To safely utilize this route, we must be competent in our knowledge of venous anatomy and physiology and its application.

LESSON PLAN: 2
COURSE TITLE: INTRAVENOUS FLUID THERAPY
UNIT III ANATOMY AND PHYSIOLOGY AS APPLIED TO
INTRAVENOUS THERAPY

OUTLINE: (Key Points)

I. Anatomy and Physiology of the Circulatory System (II-1)

A. Structure (HO 1)

1. Arteries

- a. Elastic muscular tubes
- b. Recoil forces blood onward in pulsating waves - reflect ventricular beat
- c. Layers
 - (1) Tunica intima (inner layer)
 - (2) Tunica media - thicker than in veins (middle layer)
 - (3) Tunica adventitia (outer layer)
- d. Blood supply - vasa vasorum

2. Arterioles - small extensions of arteries connecting to capillaries

3. Capillaries (TM 1) - Microscopic vessels between arterioles and venules - walls single cell thickness

4. Venules - small extensions of vein connecting to capillaries

5. Veins

- a. More numerous than arteries
- b. Thinner walled than arteries
- c. Layers
 - (1) Tunica intima (inner layer)
 - (2) Tunica media (middle layer)
 - (3) Tunica (externa) adventitia (outer layer)
- d. Valves prevent backflow of blood

B. Function (HO 2)

1. Arteries

- a. Supply oxygenated blood to most tissues and cells
- b. Carry carbon dioxide blood to lungs

2. Arterioles - carry O₂ blood from arteries to capillaries

3. Capillaries - exchange between blood and interstitial fluids takes place through capillary wall

4. Venules - carry CO₂ blood

5. Veins

- a. Carry CO₂ blood from most tissues and cells
- b. Carry O₂ blood from lungs

II. Circulatory System of the Upper Arm and Torso

A. Identification of major veins of the arm (HO 3)

- 1. Axillary
- 2. Cephalic
- 3. Brachial
- 4. Median basilic
- 5. Basilic
- 6. Ulnar
- 7. Radial
- 8. Metacarpal (HO 4)

B. Identification of major central veins of upper torso (HO 5)

- 1. Subclavian
- 2. Jugular
 - a. Internal
 - b. External

C. Identification of major central vein of lower torso - femoral

III. Vasovagal Reaction

(II-2)

- A. Undesirable autonomic nervous system response
- B. Manifested by vasoconstriction
- C. Frequently seen in IV therapy patients
- D. Predisposing factors
 - 1. Preconceived fear of needles or IV therapy itself
 - 2. Previous IV associated traumatic experience (multiple unsuccessful venipuncture attempts)
 - 3. Unfamiliarity with venipuncture procedure (lack of or inadequate patient preparation)
- E. May constitute real threat to patient with severe cardiac disease

IV. Summary and Conclusion

- A. Anatomy and physiology of the circulatory system
- B. Circulatory system of the upper arm and torso
- C. Vasovagal reaction

LESSON PLAN: 2
COURSE TITLE: INTRAVENOUS FLUID THERAPY
UNIT III ANATOMY AND PHYSIOLOGY AS APPLIED TO
INTRAVENOUS THERAPY

INTERACTION ITEMS:

1. Why are the differences between arteries and veins important to the administration of IV therapy?
2. Why is it important for the nurse to know the factors that could predispose an IV therapy patient to a vasovagal reaction?

CLASSROOM, LABORATORY, OR OTHER ACTIVITIES:

1. Have students locate and identify upper extremity veins on one another.

LESSON PLAN: 2
COURSE TITLE: INTRAVENOUS FLUID THERAPY
UNIT III ANATOMY AND PHYSIOLOGY AS APPLIED TO
INTRAVENOUS THERAPY

EVALUATION ITEMS:

Match the organs of the circulatory system to the appropriate structure and/or function.

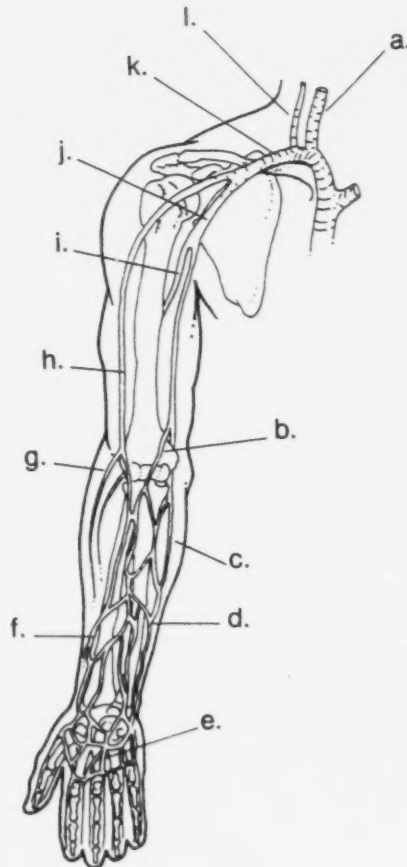
- | | | |
|-------|---|----------------|
| _____ | 1. Elastic muscular tube | a. Venules |
| _____ | 2. Microscopic vessels between arterioles and venules | b. Capillaries |
| _____ | 3. More numerous than arteries | c. Arterioles |
| _____ | 4. Connects arteries and capillaries | d. Veins |
| _____ | 5. Connect capillaries and veins | e. Arteries |

6. Label the four structures of a veins:

- a.
- b.
- c.
- d.

7. Match the veins of the upper extremity and torso to location

- ___ 1. Accessory cephalic
- ___ 2. Brachial
- ___ 3. Median basilic (cubital)
- ___ 4. Cephalic (radial)
- ___ 5. Basilic
- ___ 6. Ulnar
- ___ 7. Axillary
- ___ 8. Upper cephalic
- ___ 9. Metacarpal
- ___ 10. Subclavian
- ___ 11. Internal jugular
- ___ 12. External jugular



8. List three factors that could predispose an IV therapy patient to a vasovagal reaction.

- a.
- b.
- c.

LESSON PLAN: 2

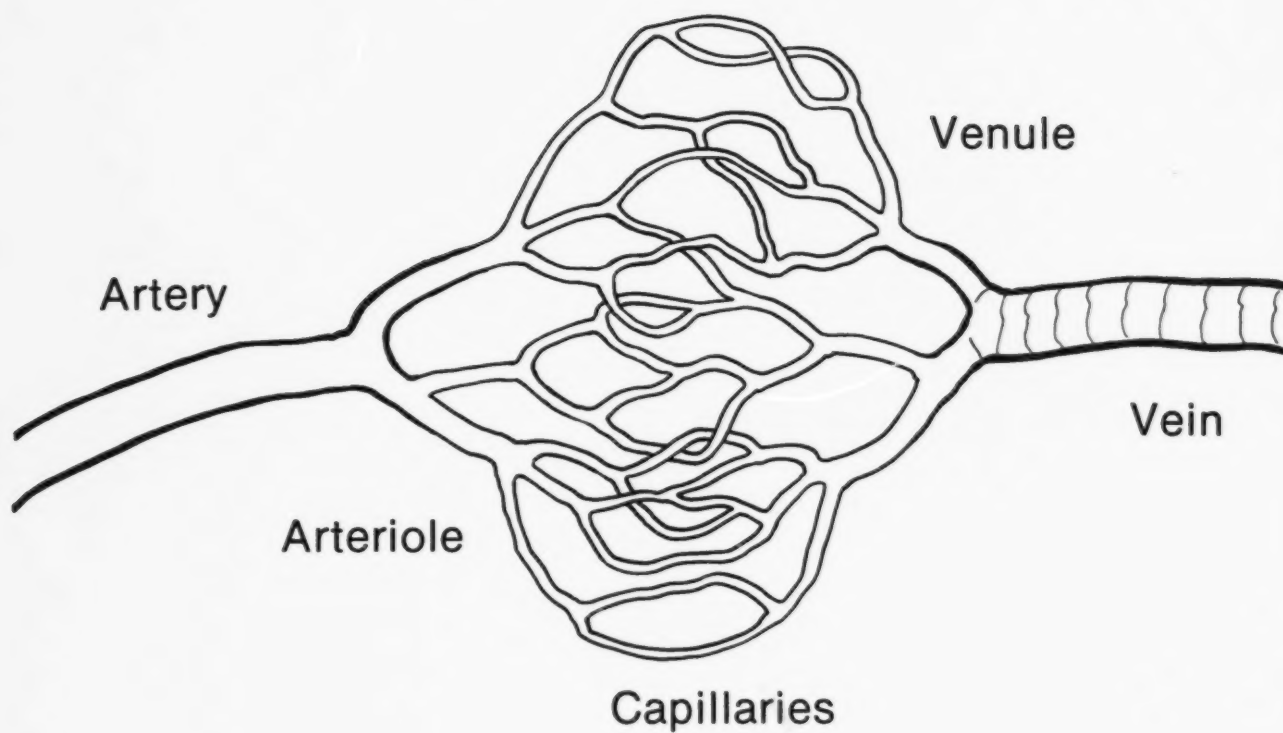
COURSE TITLE: INTRAVENOUS FLUID THERAPY

UNIT III ANATOMY AND PHYSIOLOGY AS APPLIED TO
INTRAVENOUS THERAPY

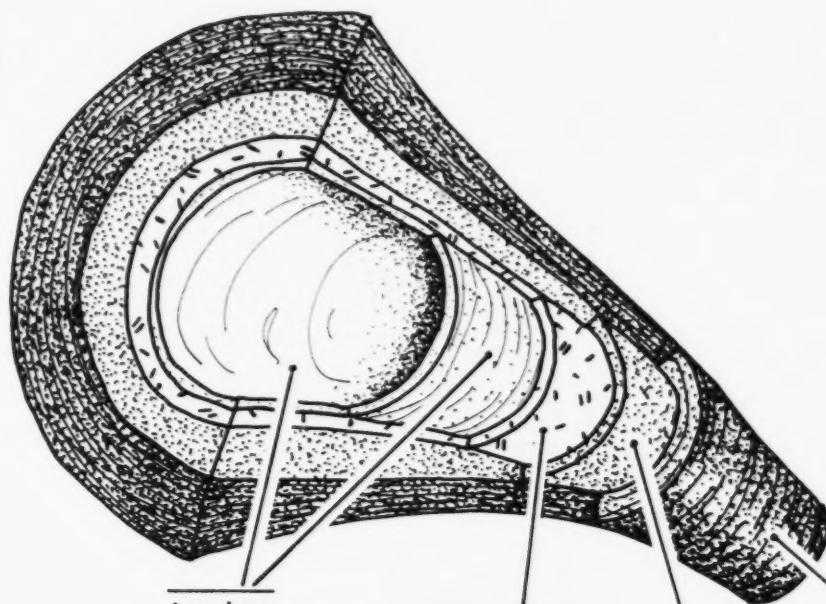
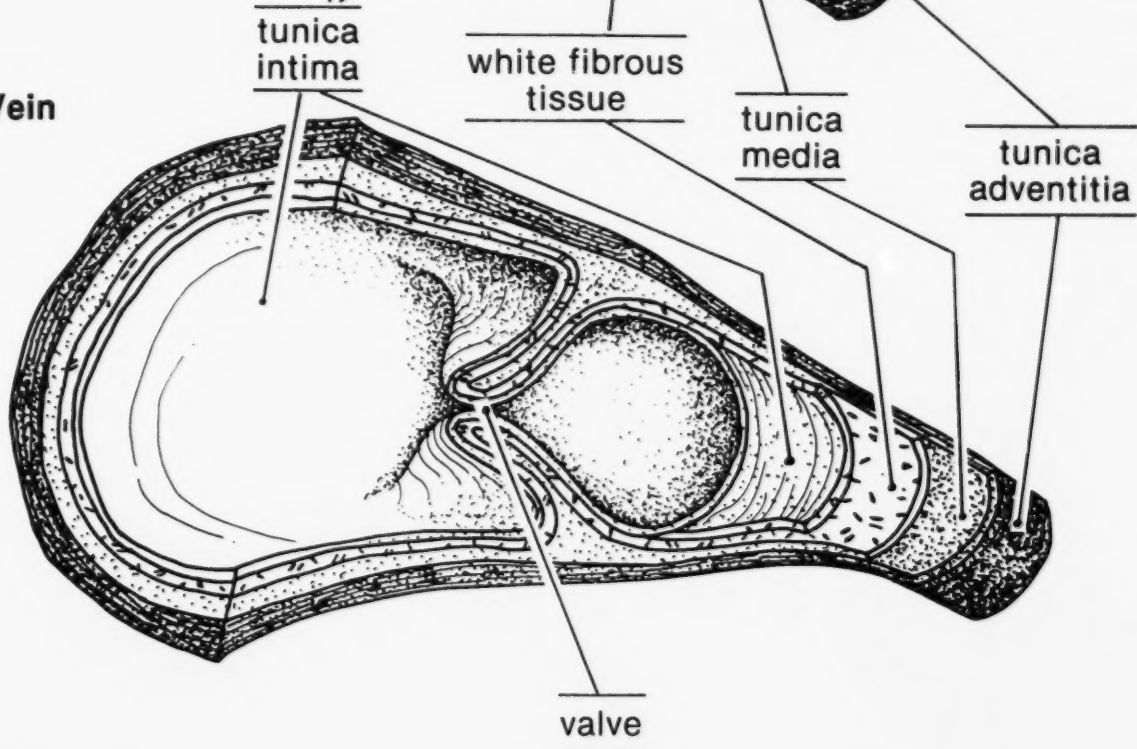
ANSWERS TO EVALUATION ITEMS:

1. e
2. b
3. d
4. c
5. a
6.
 - a. Tunica intima
 - b. Tunica media
 - c. Tunica adventitia
 - d. Valve
7.
 1. g
 2. i
 3. b
 4. f
 5. c
 6. d
 7. j
 8. h
 9. e
 10. k
 11. a
 12. l
8.
 - a. Preconceived fear of needles/IV therapy
 - b. Previous IV therapy associated traumatic experience
 - c. Unfamiliarity with venipuncture procedure

Capillary System



Blood Vessel Structure

Artery**Vein**

tunica
intima

white fibrous
tissue

tunica
media

tunica
adventitia

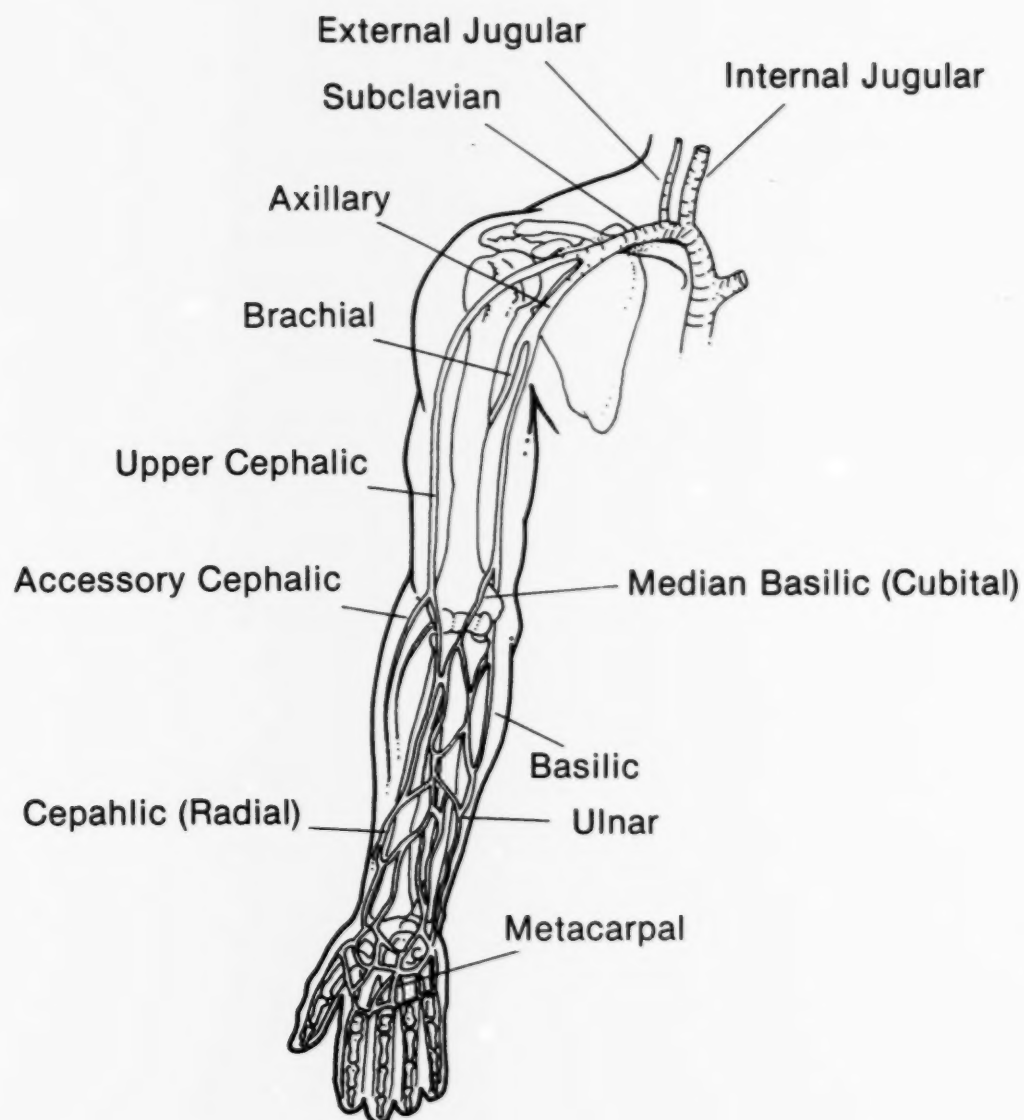
valve

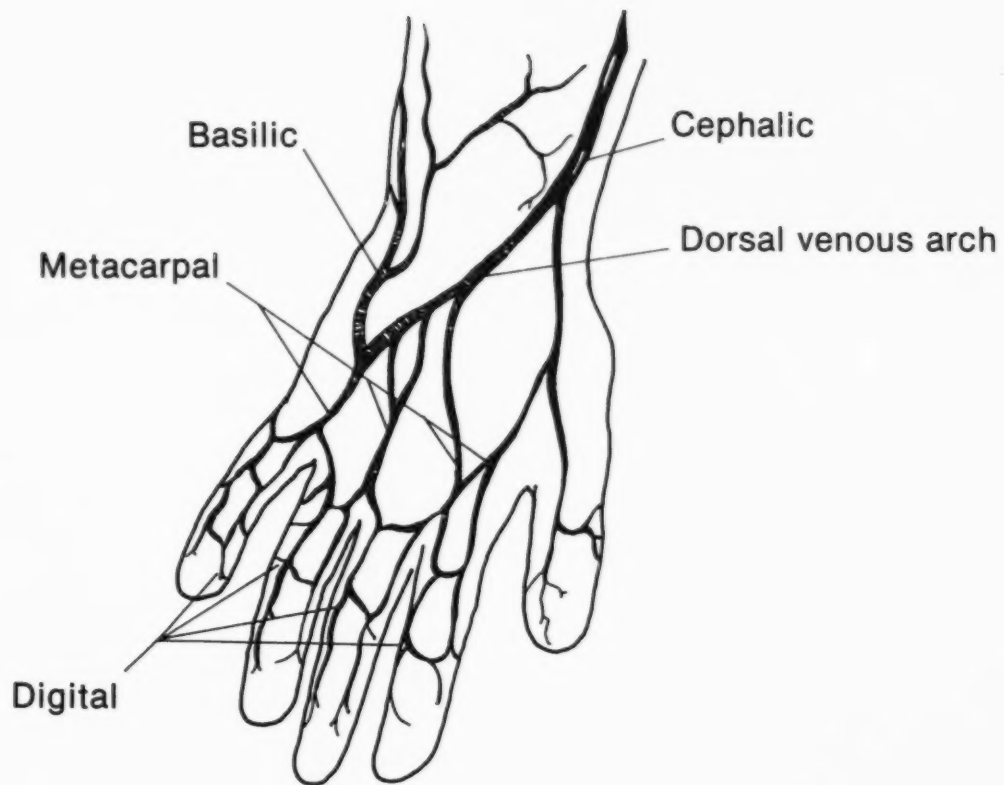
Characteristics of Arteries and Veins

Characteristic	Artery	Vein
Body Location	Located deep in body tissue beneath muscle layers (exception is "aberrant artery" which is located superficially and in an unusual place)	Superficial: located immediately beneath skin in superficial fascia Deep: located deep in tissue near principle arteries
Flow Direction	Carries blood away from heart	Carries blood toward heart
Role in Circulation	A specific area is supplied by a single artery; injury or malfunction of the artery threatens circulation in the area it supplies, possible tissue death could result	Veins are numerous and generally arranged in networks to supply a specific area; injury or malfunction of a vein is compensated for by others, and circulation is maintained
Valves	No valves - continual pressure of blood moving away from heart assures circulation	Function in opposition to muscular pressure to prevent backflow as blood moves toward heart
Pulsation	Pulsates when left ventricle contracts and blood is forced into aorta	No pulsation
Color of Blood	Bright in color resulting from oxygenated blood delivered from lungs or pulmonary circulation	Dark red in color indicating presence of materials drained from tissue by capillaries

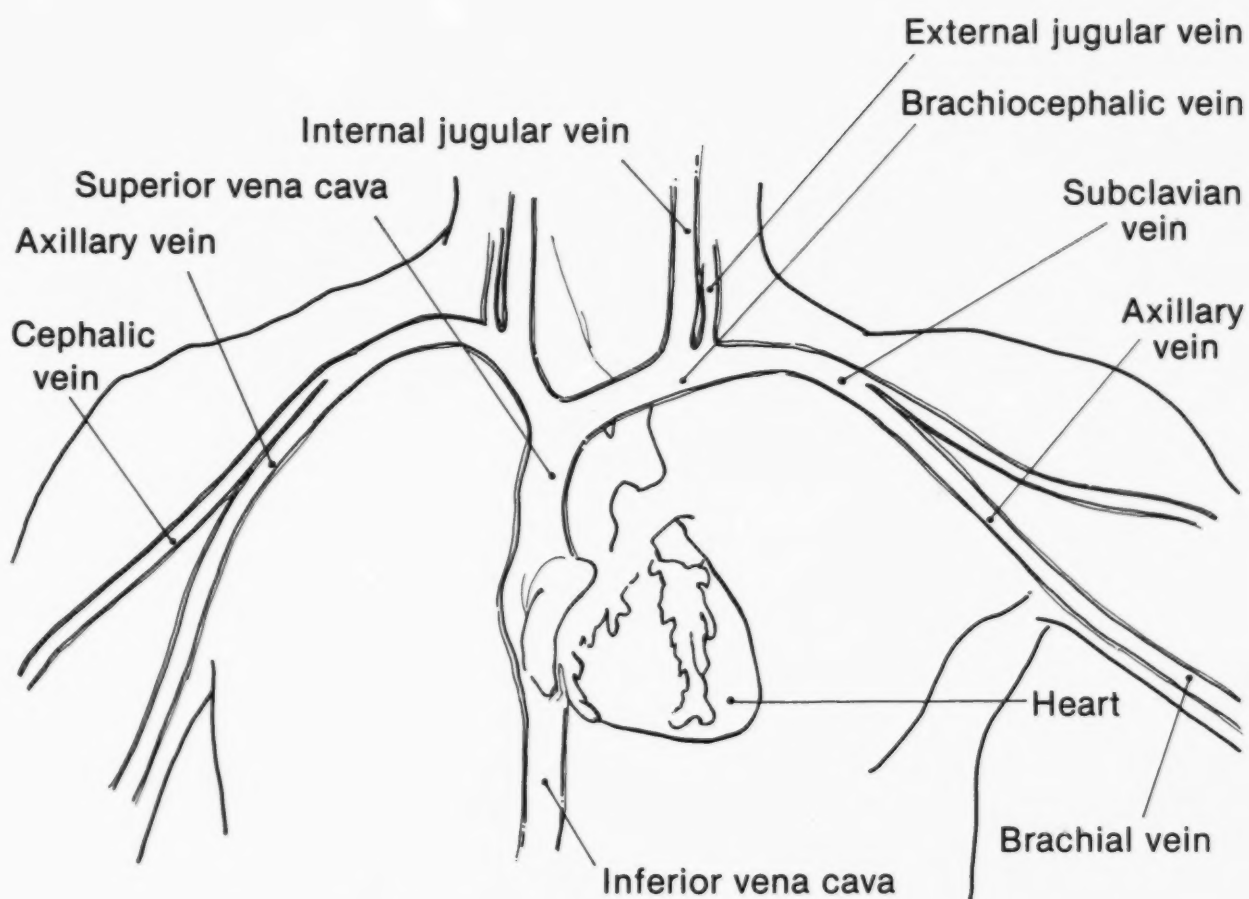
Major Veins of the Right Arm and Upper Torso

HO 3





Central Veins of the Upper Torso



LESSON PLAN: 3
COURSE TITLE: INTRAVENOUS FLUID THERAPY
UNIT III ANATOMY AND PHYSIOLOGY AS APPLIED TO
INTRAVENOUS THERAPY

SCOPE OF UNIT:

This unit includes the anatomy and physiology of the skin, circulatory system, cardiopulmonary system, and a review of hematology as they relate to the administration of IV fluid.

INFORMATION TOPIC: X OR DEMONSTRATION:

THE CARDIOPULMONARY SYSTEM
(Lesson Title)

LESSON OBJECTIVES - THE STUDENT WILL BE ABLE TO:

1. Match terms associated with anatomy and physiology of the cardiopulmonary system to correct definitions.
2. Identify anatomical structures of the heart.
3. State the function of the heart.
4. List two IV therapy related factors that can cause alterations of the cardiopulmonary system.
5. Trace the circulation of blood through the cardiopulmonary system.

SUPPLEMENTARY TEACHING/LEARNING ITEMS:

1. HO 1: The Cardiopulmonary System: The Anatomical Structures
2. HO 2: The Heart: Circulation of Blood
3. Brady filmstrip: "Cardiovascular System"
4. Singer filmstrip: "Respiratory System" (A-569-9)
5. Brady overhead: "Respiratory" (Unit 7, sheets 8 and 9)
6. Heart model

INFORMATIONAL ASSIGNMENT:

Plumer, Ada Lawrence. Principles and Practice of Intravenous Therapy. 4th ed. Boston: Little, Brown & Co., 1987.

Thomas, Virginia. Life Sciences for Nursing and Health Technologies. 3rd ed. Long Beach, CA: Technicourse, 1977, pp. 75-100.

REFERENCES:

Anthony, Catherine Parker and Gary A. Thibodeau. Structure and Function of the Body. St. Louis: Times Mirror/Mosby College Publishing Co., 1984, p. 227.

Chaffe, Ellen and Ivan Lytle. Basic Physiology and Anatomy. 4th ed. Philadelphia: J.B. Lippincott & Co., 1980, chs. 15-17.

Marieb, Elaine Nicpon. Essentials of Human Anatomy and Physiology. Menlo Park, CA: Addison-Wesley Publishing Co., 1984, pp. 203-204.

Plumer, Ada Lawrence. Principles and Practice of Intravenous Therapy. 4th ed. Boston: Little, Brown & Co., 1987.

Rosdahl, Caroline B. Textbook of Basic Nursing. 3rd ed. Philadelphia: J.B. Lippincott & Co., 1981, pp. 104-114.

Thomas, Virginia. Life Sciences for Nursing and Health Technologies. 3rd ed. Long Beach, CA: Technicourse, 1977, pp. 75-100.

INTRODUCTION:

The heart is a powerful muscular pump that is essential to the circulatory system's transportation of needed oxygen and nutrients to the cells and removal of waste products from them. As the heart pumps blood through the vascular system, it is routed through the lungs where oxygen and carbon dioxide exchange takes place. These two vital organs, combined as the cardiopulmonary system, play a major role in homeostasis. In this lesson you will learn how the cardiopulmonary system not only affects IV fluids and medications that are administered, but, in reverse, can be greatly affected by IV administration.

LESSON PLAN: 3
COURSE TITLE: INTRAVENOUS FLUID THERAPY
UNIT III ANATOMY AND PHYSIOLOGY AS APPLIED TO
INTRAVENOUS THERAPY

OUTLINE: (Key Points)

I. Terms and Definitions

- A. Edema - abnormal accumulation of fluid in tissues
- B. Pathophysiology - disease state that changes the structural or functional state of an organ
- C. Tricuspid - having three cusps or points
- D. Valve - any contrivance or arrangement that regulates the amount and direction of flow of liquid, gas, vapor, or loose material

II. The Heart

A. Anatomy of the heart (HO 1)

1. Structural features

- a. Description - hollow, muscular organ in mediastinum; base directed upward to right, apex down to left
- b. Heart chambers and valves
 - (1) Right atrium receives from vena cava and coronary sinus; empties into right ventricle.
 - (2) Right atrioventricular (tricuspid) valve prevents backflow from right ventricle to right atrium.
 - (3) Left atrium receives from pulmonary veins; empties into left ventricle.
 - (4) Left atrioventricular (bicuspid, mitral) valve prevents backflow from left ventricle to left atrium.
 - (5) Right ventricle pumps blood into pulmonary artery; backflow from artery prevented by pulmonary semilunar valve.

- (6) Left ventricle pumps blood into aorta; backflow from aorta prevented by aortic semilunar valve. Left ventricular walls thicker than right; must generate more pressure to pump into larger circuit.

2. Blood supply to myocardium

- a. Right and left coronary arteries give off intramuscular branches to capillaries in heart wall; blood flow decreased by compression of vessels during ventricular contraction, increased during relaxation.
- b. Coronary veins drain capillaries; most empty into coronary sinus.
- c. Interference with blood supply may cause heart attack.

- B. Physiology of the heart - sole function is to pump into arterial system blood returned to it from venous system (HO 2) (II-1)

1. Right side of heart receives poorly oxygenated blood; pumps to lungs.
2. Left side of heart receives highly oxygenated blood from lungs; pumps to other parts of body.

- C. IV therapy related factors causing variations in heart function

1. Medications
2. Fluid/electrolyte imbalances
3. Fluid overload
4. Speed shock
5. Septicemia
6. Emboli
7. Vasovagal reaction

- III. The Pulmonary System (HO 3)

- A. Function - exchange of gases between organism and environment supplying oxygen to the body and eliminating carbon dioxide
- B. Importance relative to IV therapy - maintenance of acid-base balance

C. IV therapy related factors affecting respiratory rates

(11-2)

1. Chemical - pH

- a. Stimulation of central chemoreceptors by carbon dioxide and hydrogen ions in cerebrospinal fluid of fundamental importance

- (1) Resultant increase in rate and depth of breathing enables one to blow off CO₂ which reduces carbonic acid in blood

- (2) Limits voluntary control

- b. Peripheral chemoreceptor reflexes

- (1) Impulses from aortic and carotid bodies when O₂ level falls

- (2) Increase breathing rate

2. Physical

- a. Medication

- b. Fluid overload

- c. Fluid and electrolyte imbalances

- d. Temperature of transfused blood

- e. Emboli

IV. Summary and Conclusion

- A. Terms and definitions

- B. The heart

- C. The pulmonary system

LESSON PLAN: 3
COURSE TITLE: INTRAVENOUS FLUID THERAPY
UNIT III ANATOMY AND PHYSIOLOGY AS APPLIED TO
INTRAVENOUS THERAPY

INTERACTION ITEMS:

1. Why is it necessary to know the normal functions of the cardiopulmonary system?
2. Why should a nurse know the factors affecting the respiratory rate?

CLASSROOM, LABORATORY, OR OTHER ACTIVITIES:

1. Refer students to HO 2 and trace blood flow through the heart.

LESSON PLAN: 3

COURSE TITLE: INTRAVENOUS FLUID THERAPY

UNIT III ANATOMY AND PHYSIOLOGY AS APPLIED TO
INTRAVENOUS THERAPY

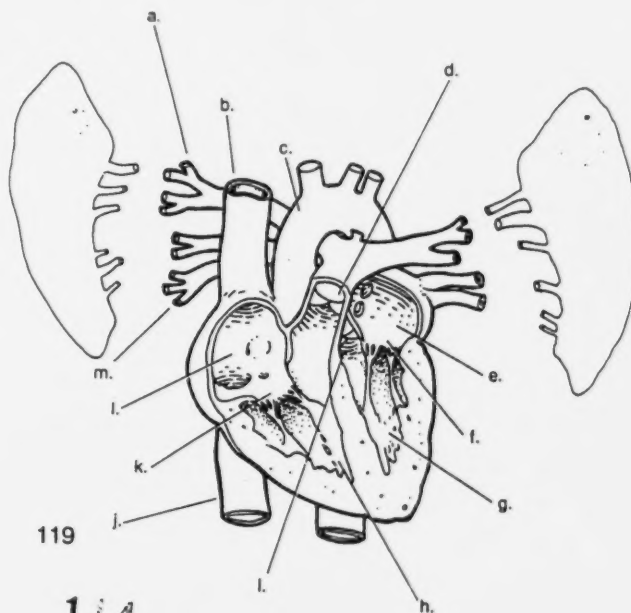
EVALUATION ITEMS:

Match terms associated with anatomy and physiology of the cardio-pulmonary system to correct definitions.

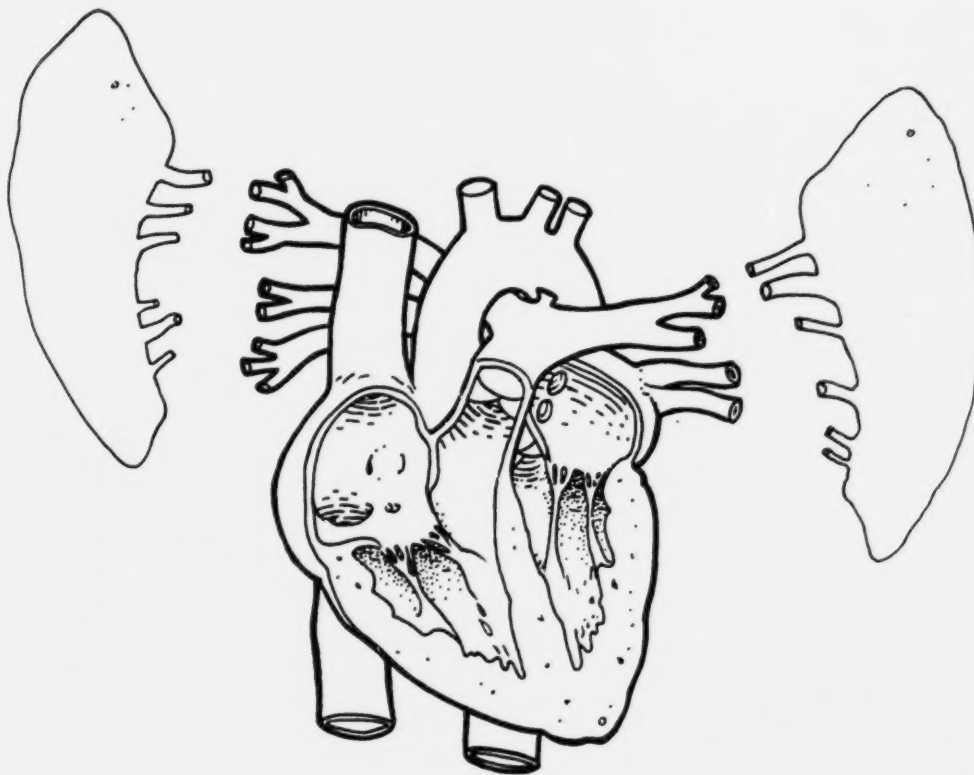
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|-------|--|--------------------|
| _____ | 1. Any contrivance or arrangement that regulates the amount and direction of flow of liquid, gas, vapor, or loose material | a. Tricuspid |
| _____ | 2. Disease state that changes the structural or functional state of an organ. | b. Valve |
| _____ | 3. Abnormal accumulation of fluid in tissues | c. Pathophysiology |
| _____ | 4. Having three cusps or points | d. Edema |

Match the letters on the diagram shown below to the proper anatomical structure.

- | | | | |
|-----------|---------------------------|-----------|------------------------|
| 5. _____ | Pulmonary semilunar valve | 16. _____ | Inferior vena cava |
| 6. _____ | Left atrium | 17. _____ | Aortic semilunar valve |
| 7. _____ | Right ventricle | | |
| 8. _____ | Tricuspid valve | | |
| 9. _____ | Pulmonary arteries | | |
| 10. _____ | Bicuspid (mitral) valve | | |
| 11. _____ | Aortic arch | | |
| 12. _____ | Superior vena cava | | |
| 13. _____ | Left ventricle | | |
| 14. _____ | Pulmonary veins | | |
| 15. _____ | Right atrium | | |



18. State the function of the heart.
19. List two IV therapy related factors that can cause alterations of the cardio-pulmonary system.
- a.
 - b.
20. Trace the flow of blood through the heart in the diagram below starting at the superior vena cava. Indicate oxygenated blood with a double arrow and unoxygenated blood with a single arrow.



LESSON PLAN: 3

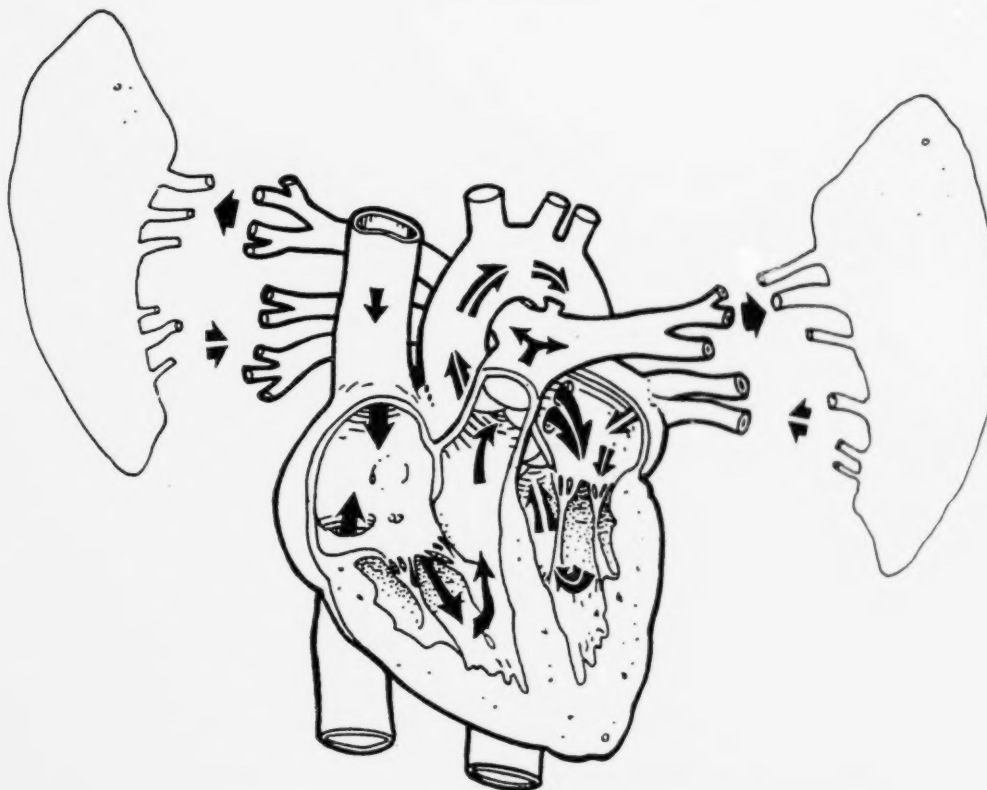
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UNIT III ANATOMY AND PHYSIOLOGY AS APPLIED TO

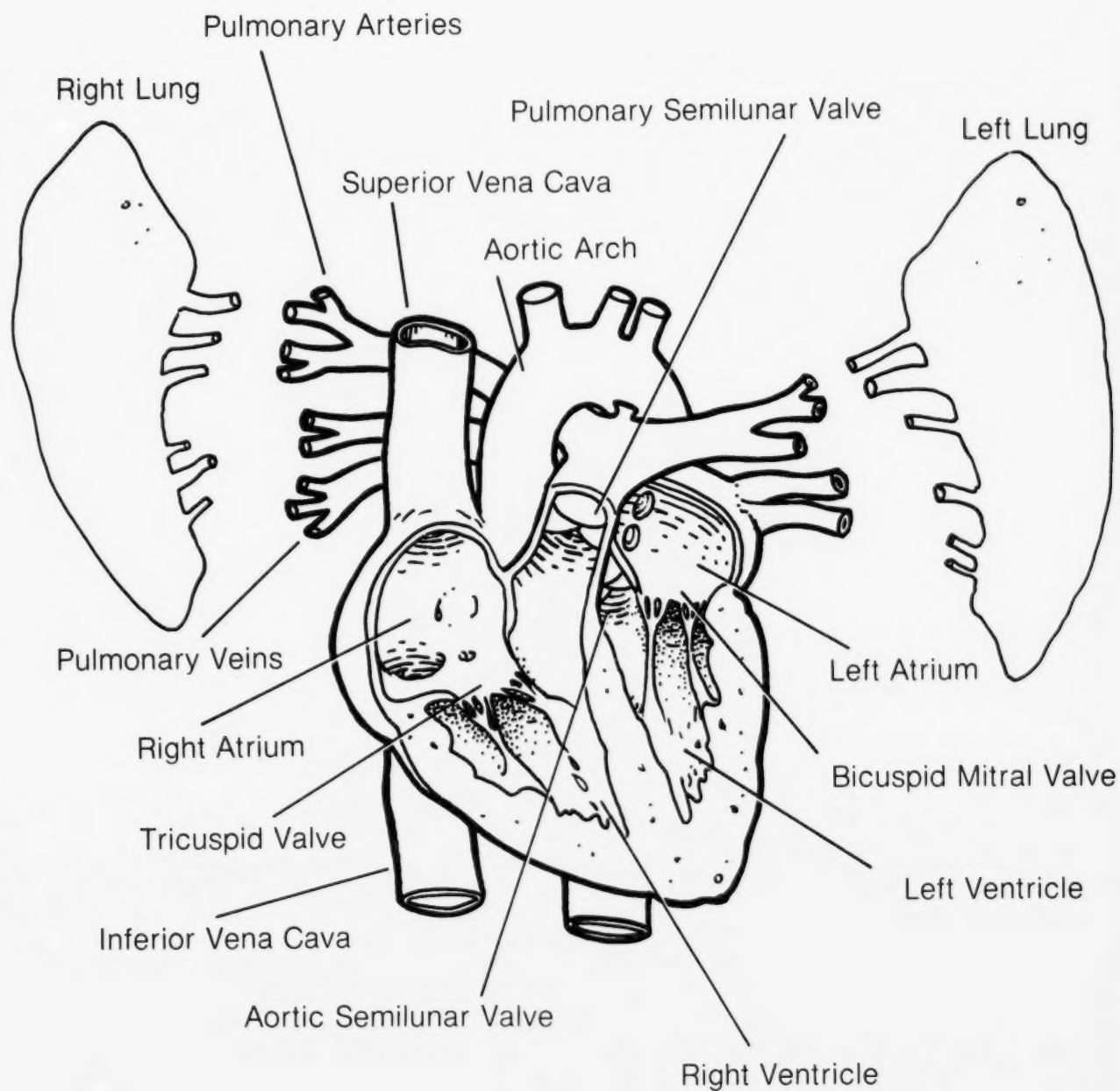
INTRAVENOUS THERAPY

ANSWERS TO EVALUATION ITEMS:

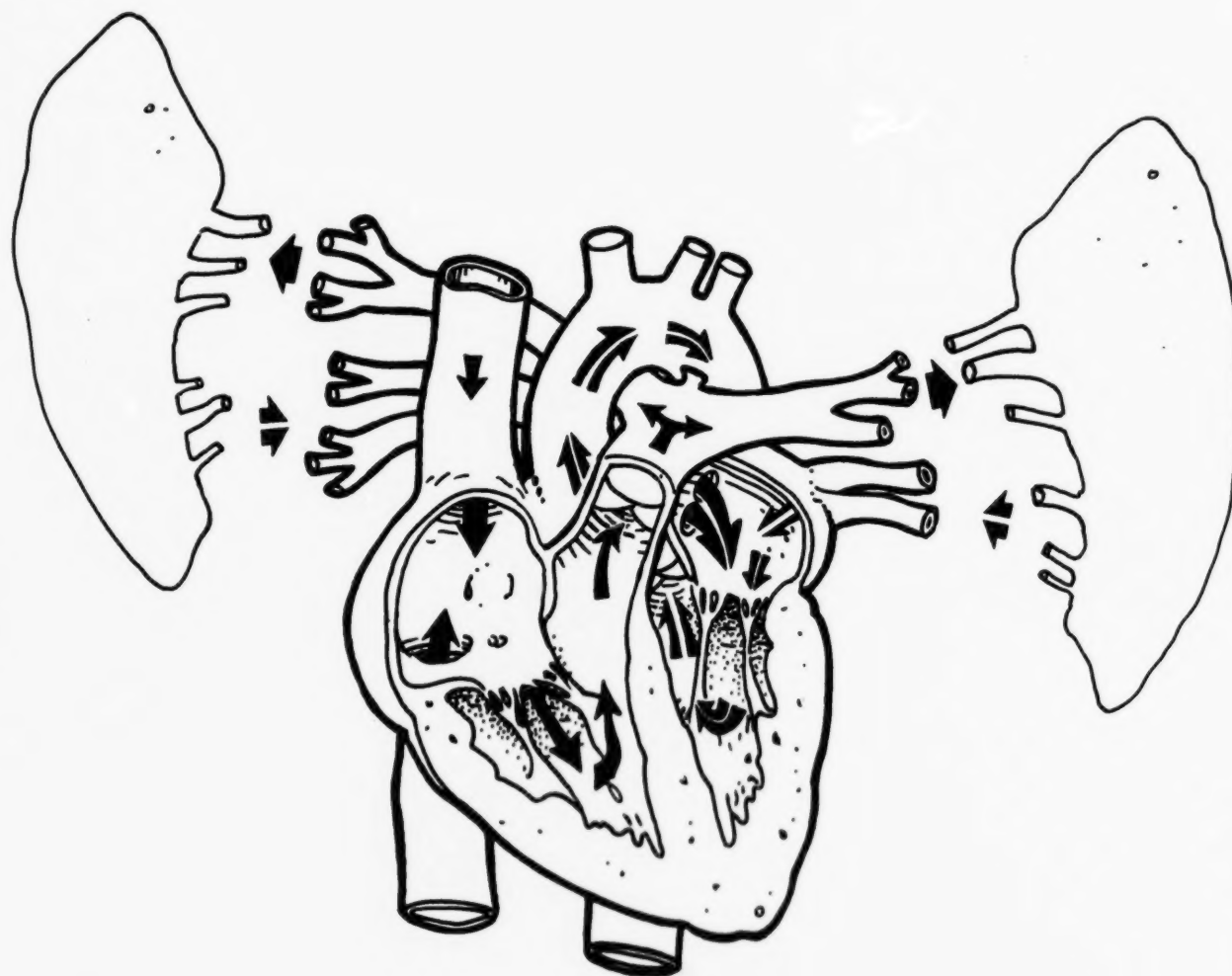
- | | | | |
|-----|---|-----|---|
| 1. | b | 14. | m |
| 2. | c | 15. | l |
| 3. | d | 16. | j |
| 4. | a | 17. | i |
| 5. | d | 18. | to pump blood |
| 6. | e | 19. | The student may list any two of the following |
| 7. | h | a. | Medications |
| 8. | k | b. | Fluid/electrolyte imbalances |
| 9. | a | c. | Fluid overload |
| 10. | f | d. | Speed shock |
| 11. | c | e. | Septicemia |
| 12. | b | f. | Emboli |
| 13. | g | g. | Vasovagal reactions |
| 20. | | h. | Temperature of transfused blood |



Cardiopulmonary System: The Anatomical Structures



The Heart: Circulation of Blood



LESSON PLAN: 4
COURSE TITLE: INTRAVENOUS FLUID THERAPY
UNIT III ANATOMY AND PHYSIOLOGY AS APPLIED TO
INTRAVENOUS THERAPY

SCOPE OF UNIT:

This unit includes the anatomy and physiology of the skin, circulatory system, cardiopulmonary system, and a review of hematology as they relate to the administration of IV fluid.

INFORMATION TOPIC: X OR DEMONSTRATION:

HEMATOLOGY
(Lesson Title)

LESSON OBJECTIVES - THE STUDENT WILL BE ABLE TO:

1. Match the terms hematology, anemia, and plasma to correct definitions.
2. State the number of liters of blood in an adult.
3. List three functions of blood.
4. Match formed elements in blood to the correct functions.
5. List, in order, the steps in the blood clotting process.
6. Name two factors that can alter the normal blood clotting process.

SUPPLEMENTARY TEACHING/LEARNING ITEMS:

1. HO 1: Erythrocytes
2. HO 2: Leukocytes
3. HO 3: Thrombocytes
4. HO 4: The Blood Clotting Process

INFORMATIONAL ASSIGNMENT:

Anthony, Catherine Parker and Gary A. Thibodeau. Structure and Function of the Body. 7th ed. St. Louis: Times Mirror/Mosby College Publishing Co., 1984.

Thomas, Virginia. Life Sciences for Nursing and Health Technologies. 3rd ed. Long Beach, CA: Technicourse, 1977.

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Chaffee, E. and Ivan M. Lytle. Basic Physiology and Anatomy. 4th ed. Philadelphia: J.B. Lippincott & Co., 1980.

Thomas, Virginia. Life Sciences for Nursing and Health Technologies. 3rd ed. Long Beach, CA: Technicourse, 1977.

INTRODUCTION:

The study of blood is called hematology. Blood is important since it maintains homeostasis in the body by keeping the internal environment constant.

LESSON PLAN: 4
COURSE TITLE: INTRAVENOUS FLUID THERAPY
UNIT III ANATOMY AND PHYSIOLOGY AS APPLIED TO
INTRAVENOUS THERAPY

OUTLINE: (Key Points)

- I. Terms and Definitions Related to Blood
 - A. Anemia - deficiency of Hgb in blood
 - B. Hematology - study of blood
 - C. Plasma - fluid portion of blood
- II. Functions of Blood
 - A. Delivers vital substances to capillaries
 - B. Picks up metabolic end products and delivers to organs for use or elimination
 - C. Aids in regulation of body temperature
 - D. Helps to maintain acid-base balance
 - E. Protects against bacterial invasion and disease
- III. Amount of Blood - approximately 7% of body weight (5 liters)
- IV. Blood Formation - hemopoietic tissue found in red bone marrow and lymphatic tissue
- V. Blood Components (II-I)
 - A. Plasma - 53-58% of blood
 - I. Water
 - a. Amount - 92%
 - b. Function
 - (1) Delivers nutrients and inorganic salts
 - (2) Removes gases, waste products and special substances

2. Blood proteins - assist in blood clotting and immune system
3. Nutritive materials - assist in metabolism
 - a. Carbohydrates - present in form of glucose (blood sugar)
 - b. Proteins
 - c. Fats
4. Mineral salts
5. Gases - found in solution in plasma in small amounts; assist in pH balance
 - a. Oxygen
 - b. Carbon dioxide
6. Waste products - carried in plasma to organs of elimination to assist in removal of toxins
7. Hormones - transported in plasma to tissue in all parts of body
8. Antibodies - function is to assist in immunity development
9. Enzymes - function is to assist in body metabolism

B. Formed elements in blood

1. Erythrocytes - red blood cells (HO 1)
 - a. Formed in red bone marrow
 - b. Hemoglobin aids in transport of oxygen and carbon dioxide; average hemoglobin content: female 14 gm, male 16 gm per 100 ml blood (II-2)
 - c. Average range for number of red cells 4.5 to 5.5 million per cu mm of blood (II-2)
 - d. Average range for hematocrit - 32-46%
2. Leukocytes - white blood cells (HO 2)
 - a. General function
 1. Protects body against infection
 2. Lymphocytes may be concerned with immunity reactions and give rise to plasma cells
 - b. Absolute count falls within range of 5,000 to 10,000 per cu mm of blood (II-2)

3. Thrombocytes - blood platelets (HO 3)
 - a. Function - help in control of bleeding (clotting)
 - b. Average count between 150,000 and 350,000

VI. Blood Clotting

A. Mechanisms

1. Blood normally flows past the endothelium of the blood vessel walls.
2. If vessel wall is damaged, "blood clotting cascade" is set into motion.
3. Blood clotting or coagulation reduces blood loss when blood vessels are ruptured.
4. Clotting process (HO 4)
 - a. Platelets cling to the damaged site and pile up to form a small mass of platelets called a white thrombus, or platelet plug.
 - b. Once anchored, the platelets release serotonin which causes the blood vessel to go into spasms. The spasms narrow the blood vessel at that point thus decreasing blood loss until clotting can occur.
 - c. At the same time, the injured tissues and the platelets are releasing thromboplastin, which triggers the clotting cascade.
5. Blood normally clots within 2-6 minutes.
6. Once the clotting cascade has started, the triggering factors are rapidly inactivated to prevent widespread clotting.

- B. Alterations - lack of any of the factors needed for clotting can lead to a decreased ability to form clots (II-3)

1. Certain disease processes
2. Certain medications/chemotherapy

VI. Summary

- A. Terms and definitions related to blood
- B. Functions of blood
- C. Amount of blood

- D. Blood formation
- E. Blood components
- F. Blood clotting

LESSON PLAN: 4
COURSE TITLE: INTRAVENOUS FLUID THERAPY
UNIT III ANATOMY AND PHYSIOLOGY AS APPLIED TO
INTRAVENOUS THERAPY

INTERACTION ITEMS:

1. Why is it a necessity for any nurse instituting, monitoring, or discontinuing an IV to be aware of the components of blood?
2. Why should a nurse be aware of normal lab values?
3. Why should a nurse be aware that certain disease processes and medication/chemotherapy administration may result in an alteration of the blood clotting mechanism?

CLASSROOM, LABORATORY, OR OTHER ACTIVITIES:

1. Have students bring lab value sheets from institutions for review.

LESSON PLAN: 4
COURSE TITLE: INTRAVENOUS FLUID THERAPY
UNIT III ANATOMY AND PHYSIOLOGY AS APPLIED TO
INTRAVENOUS THERAPY

EVALUATION ITEMS:

Match the terms below to their definitions.

- | | | |
|-------|---------------|-------------------------------|
| _____ | 1. Anemia | a. Study of blood |
| _____ | 2. Plasma | b. Deficiency of Hgb in blood |
| _____ | 3. Hematology | c. Fluid portion of blood |

4. State the approximate number of liters of blood in an adult.

5. List three functions of blood.

- a.
- b.
- c.

6. Number the steps in the blood clotting process in order of occurrence (1-5).

- _____ a. Blood vessel goes into spasm narrowing vessel to decrease blood loss.
- _____ b. Thrombin works with fibrinogen to produce fibrin to form a meshwork which traps erythrocytes.
- _____ c. Platelets form a white thrombus or platelet plug.
- _____ d. Platelets release thromboplastin.
- _____ e. Platelets release serotonin.

Match formed elements of blood to function.

- | | | |
|-------|-----------------|---|
| _____ | 7. Erythrocytes | a. Protects body against infection |
| _____ | 8. Leukocytes | b. Aids in transport of oxygen and carbon dioxide |
| _____ | 9. Thrombocytes | c. Clotting |

10. Name two factors that can alter the normal blood clotting process.

a.

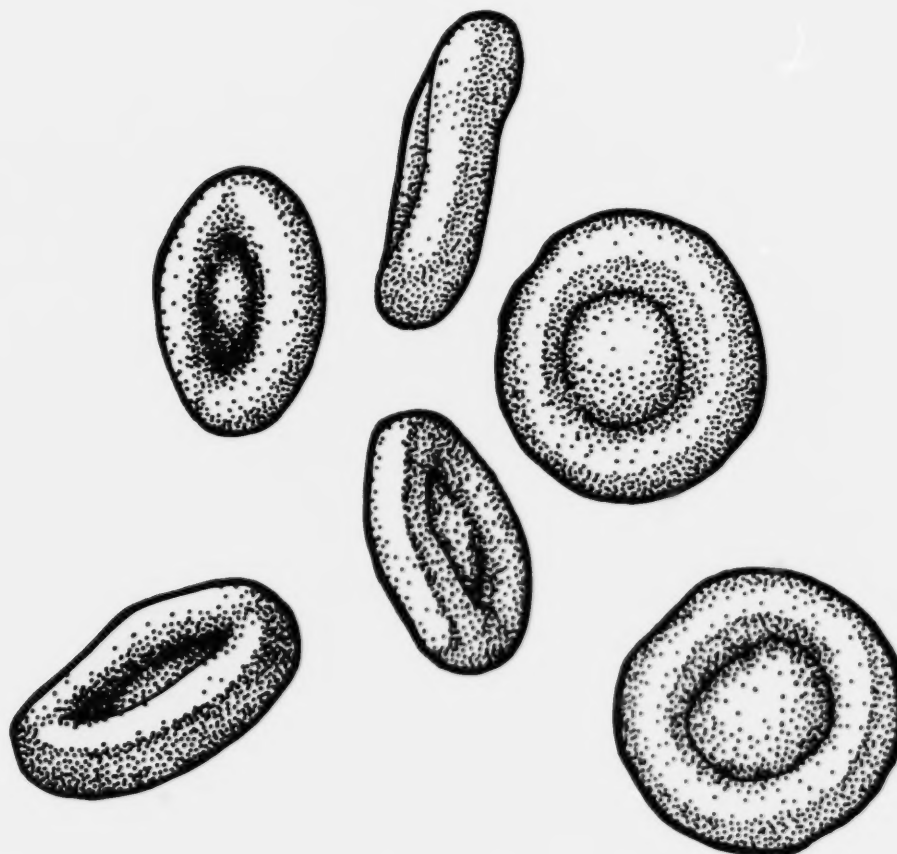
b.

LESSON PLAN: 4
COURSE TITLE: INTRAVENOUS FLUID THERAPY
UNIT III ANATOMY AND PHYSIOLOGY AS APPLIED TO
INTRAVENOUS THERAPY

ANSWERS TO EVALUATION ITEMS:

1. b
2. c
3. a
4. 5 liters
5. Any three of the following:
 - a. Delivers vital substances to capillaries
 - b. Picks up metabolic end products and delivers to organs for use or elimination
 - c. Aids in regulation of body temperature
 - d. Helps to maintain acid-base balance
 - e. Protects against bacterial invasion and disease
6.
 - a. 3
 - b. 5
 - c. 1
 - d. 4
 - e. 2
7. b
8. a
9. c
10.
 - a. Certain disease processes
 - b. Certain medications/chemotherapy

Erythrocytes (Red Blood Cells)

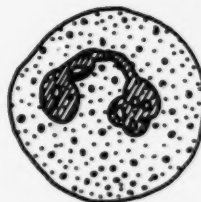
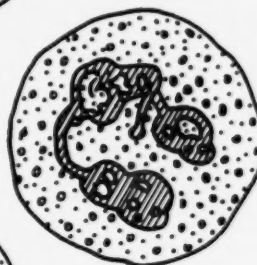
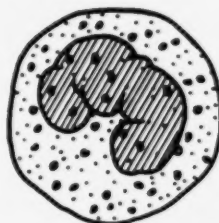


- Flexible, biconcave disks
- Contain hemoglobin which aids in transport of oxygen and carbon dioxide - average content: female 14 Gm, male 16 Gm/100 ml blood.
- Life span - 120 days
- Average range - 4.5-5.5 Million/cu mm blood

Leukocytes (White blood cells)

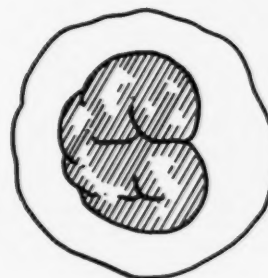
Granular Leukocytes

- Basophil
- Neutrophil
- Eosinophil



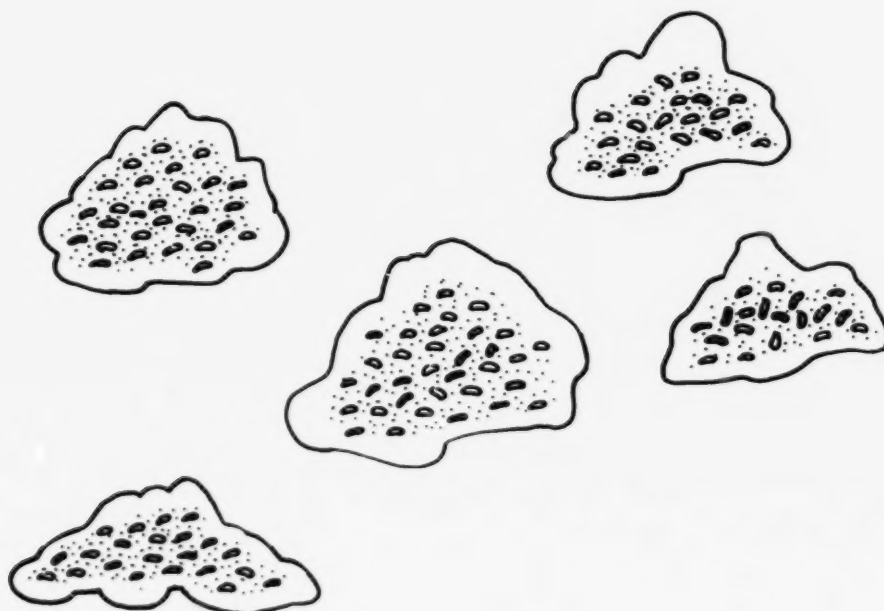
Nongranular Leukocytes

- Lymphocyte
- Monocyte



Average range - 5,000-10,000/cu mm blood.

Thrombocytes (Platelets)



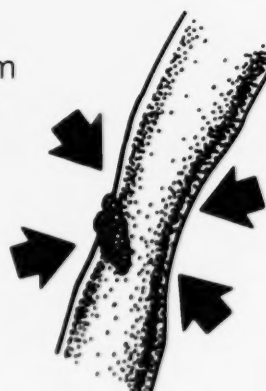
- Complex cell fragments
- Essential to blood clotting process
- Average range - 150,000-300,000/cu mm blood

Blood Clotting Process

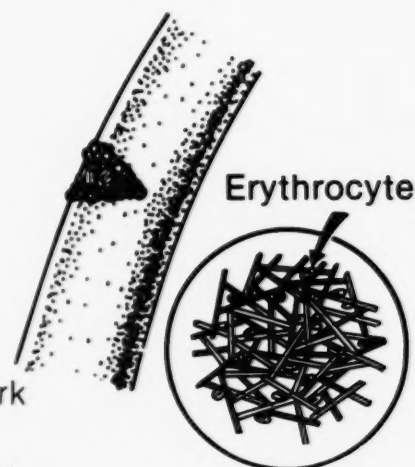
- Platelets cling to damaged site and pile up to form white thrombus or platelet plug.



- Release of serotonin causes spasm of damaged vessel which narrows it and thus decreases blood loss until clotting occurs.



- Thromboplastin released by injured tissue and platelets triggers clotting process by interacting with other blood protein clotting factors and calcium to convert prothrombin to thrombin. Thrombin works with fibrinogen to produce fibrin which forms a meshwork over the site capable of trapping erythrocytes to form the basis of a clot.



LESSON PLAN: 1

COURSE TITLE: INTRAVENOUS FLUID THERAPY

UNIT IV FUNDAMENTAL ASPECTS OF FLUID AND ELECTROLYTE
BALANCE

SCOPE OF UNIT:

This unit covers compartments and composition of body fluids, acid-base balance, regulatory mechanisms that maintain acid-base balance, disturbances of electrolyte concentrations, and parenteral fluids and their effects on homeostasis.

INFORMATION TOPIC: X

OR

DEMONSTRATION:

FLUIDS AND ELECTROLYTES
(Lesson Title)

LESSON OBJECTIVES - THE STUDENT WILL BE ABLE TO:

1. Name the percentage of body weight which is made up of water for:
 - a. Prematures
 - b. Infants
 - c. Adults
 - d. Elderly
2. Name one function of water.
3. Name a normal source of water.
4. Identify the major organs regulating fluid output.
5. List two nursing responsibilities when monitoring fluid balance.
6. List two fluid compartments.
7. Name two functions of electrolytes.
8. List five major electrolytes.
9. Define acid-base balance.
10. List two buffer systems.

11. List three major organs affecting homeostasis.
12. State normal pH of blood.
13. List two buffer systems.

SUPPLEMENTARY TEACHING/LEARNING ITEMS:

1. HO 1: Electrolytes Contained in Body Fluid
2. HO 2: Normal Lab Values
3. HO 3: The Acid-Base Scale
4. Brady filmstrip: "Metabolism"
5. Trainex #987: "IV Therapy: Preparing Patient, Selecting Intravascular Cannula, Selecting Infusion Site"

INFORMATIONAL ASSIGNMENT:

Plumer, Ada Lawrence. Principles and Practice of Intravenous Therapy. 4th ed. Boston: Little, Brown & Co., 1987.

REFERENCES:

Plumer, Ada Lawrence. Principles and Practice of Intravenous Therapy. 4th ed. Boston: Little, Brown & Co., 1987.

Burke, Shirley. The Composition and Function of Body Fluids. St. Louis: The C.V. Mosby Co., 1980.

INTRODUCTION:

The primary role of body fluids is to maintain healthy living conditions for the body cells. Fluids within the human body work within limited tolerance of volume, acidity, and electrolytes.

LESSON PLAN: I
COURSE TITLE: INTRAVENOUS FLUID THERAPY
UNIT IV FUNDAMENTAL ASPECTS OF FLUID AND ELECTROLYTE
BALANCE

OUTLINE: (Key Points)

- I. Homeostasis: Maintenance of Constant Conditions in the Internal Environment
- II. Body Water
 - A. Most abundant constituent of the body
 - B. Accounts for a significant percentage of total body weight
 1. Prematures - 90%
 2. Infants - 75-77%
 3. Adults - 50-60%
 4. Elderly - 50%
 - C. Functions of water in body
 1. Excellent solvent for a great variety of substances, including nutrients and waste products
 2. Provides for ionization of electrolytes
 3. Regulates body temperature by vaporization
- III. Water Balance
 - A. Intake (II-1)
 1. Species vary in ability to conserve water - human replaces daily - survives only a few days at most if deprived
 2. Normal sources
 - a. Free fluid in diet
 - b. Water contained in foods
 - c. Water produced by metabolic activity

B. Output

1. Normal sources of loss

- a. Lungs
- b. Skin
- c. G.I. tract
- d. Kidneys (major source)

(1) Excrete excess body fluid as urine

(2) Varying output as needed to maintain homeostasis

2. One liter body water = 1 kg or 2.2 lbs. of body weight

C. Monitoring

- 1. Accurate intake and output
- 2. Daily weights

IV. Body Fluid Compartments

(II-2)

A. Intracellular

- 1. Larger of the two compartments
- 2. Contains approximately 25 liters of fluid in a 73 kilogram adult

B. Extracellular

- 1. 22 - 26% of body weight
- 2. Subdivided into
 - a. Interstitial
 - (1) Fluid between the cells
 - (2) Approximately 12 liters
 - b. Intravascular
 - (1) Plasma
 - (2) Approximately 3 liters

c. Transcellular

(1) G.I. tract and cerebrospinal, etc.

(2) Represents very small amount at any given time

V. Composition of Body Fluid

A. Electrolytes

1. Chemical compound when dissolved in water; carry an electrical charge called an ion

a. Positive charged: cation

b. Negative charged: anion

c. Total number cations is equal to total number anions

2. Functions

a. Maintaining volume; cellular and extracellular fluid

b. Maintaining acid-base balance

c. Maintaining cellular metabolism

d. Maintaining neuromuscular activity

3. Major cations

a. Sodium (Na^+)

b. Potassium (K^+)

c. Calcium (Ca^{++})

d. Magnesium (Mg^{++})

4. Major Anions

a. Chloride (Cl^-)

b. Bicarbonate (HCO_3^-)

c. Phosphate (HPO_4^-)

B. Nonelectrolytes

1. Chemical compounds that remain intact in solution

2. Major nonelectrolytes

a. Dextrose

b. Urea

VI. Acid-Base Balance (HO 3)

- A. Definition - balance between the acids and alkalis within the body
- B. Purpose - produce chemical reactions necessary for life
- C. pH - final unit of measurement indicating if fluid is acid, neutral, or alkaline
 - 1. The lower the pH, the more acidotic the solutions.
 - 2. Normal blood plasma pH is 7.35-7.45

VII. Buffers

- A. Acid-base pairs that prevent changes in pH when acid or alkali is added to the body from the environment or then generated from within (II-3)
- B. Buffer Systems
 - 1. Respiratory - either saves or discards carbon dioxide
 - 2. Renal
 - 3. Plasma

VIII. Dynamics of Water and Electrolytes

- A. Body fluid compartments interchange constantly
- B. Hydrostatic pressure
 - 1. Develops as heart pumps blood
 - 2. Forces fluids across capillary membranes
- C. Osmotic pressure
 - 1. Fluid moves from area of lower concentration to one of higher concentration - water goes where salt is
 - 2. Terms "tonicity" and "osmolality" are interchangeable
 - 3. Isotonic - osmotic pressure equal to plasma
 - 4. Hypertonic - draws fluid from cells into plasma
 - 5. Hypotonic - forces fluid into cells

IX. Major Organs Involved in Homeostasis

- A. Kidneys
- B. Heart and blood vessels

- C. Lungs
- D. Pituitary glands
- E. Adrenal glands
- F. Parathyroid glands
- X. Summary and Conclusion
 - A. Homeostasis
 - B. Body water
 - C. Water balance
 - D. Body fluid compartments
 - E. Composition of body fluid
 - F. Acid-base balance
 - G. Buffers
 - H. Dynamics of water and electrolytes
 - I. Major organs involved in homeostasis

LESSON PLAN: I
COURSE TITLE: INTRAVENOUS FLUID THERAPY
UNIT IV FUNDAMENTAL ASPECTS OF FLUID AND ELECTROLYTE
BALANCE

INTERACTION ITEMS:

1. Why must fluid losses be monitored?
2. What are the compartments in which body fluids are stored or used?
3. Why does the body need buffering systems?

CLASSROOM, LABORATORY, OR OTHER ACTIVITIES:

1. Activities demonstrating osmosis and diffusion

LESSON PLAN: I
COURSE TITLE: INTRAVENOUS FLUID THERAPY
UNIT IV FUNDAMENTAL ASPECTS OF FLUID AND ELECTROLYTE
BALANCE

EVALUATION ITEMS:

1. What percentage of body weight is made up of water for:
 - a. Prematures -
 - b. Infants -
 - c. Adults -
 - d. Elderly -
2. One function of water is:
3. A normal source of water is:
4. List two fluid compartments.
 - a.
 - b.
5. The major organs for fluid output are:
6. List two functions of electrolytes.
 - a.
 - b.

7. Name five major electrolytes.
 - a.
 - b.
 - c.
 - d.
 - e.
8. List two nursing responsibilities when monitoring fluid balance.
 - a.
 - b.
9. Define acid-base balance.
10. List two buffer systems.
 - a.
 - b.
11. List three major organs affecting homeostasis.
 - a.
 - b.
 - c.

LESSON PLAN: I
COURSE TITLE: INTRAVENOUS FLUID THERAPY
UNIT IV FUNDAMENTAL ASPECTS OF FLUID AND ELECTROLYTE
BALANCE

ANSWERS TO EVALUATION ITEMS:

1.
 - a. Prematures - 90%
 - b. Infants - 75-77%
 - c. Adults - 50-60%
 - d. Elderly - 50%
2. Can be any of the following:
 - a. Solvent for a great variety of substances - nutrients and waste products
 - b. Provides for ionization of electrolytes
 - c. Temperature regulator
3. Can be any of the following:
 - a. Free fluid in diet
 - b. Water contained in food
 - c. Water produced by metabolic activity
4.
 - a. Extracellular
 - b. Intracellular
5. The kidneys
6.
 - a. Maintain volume ICF/ICF
 - b. Maintain acid-base balance
 - c. Maintain cellular metabolism
 - d. Maintain neuromuscular activity
7. Can be any five of the following:
 - a. Sodium
 - b. Potassium
 - c. Calcium
 - d. Phosphate
 - e. Magnesium
 - f. Bicarbonate
 - g. Phosphate
8.
 - a. Accurate I & O
 - b. Daily weighs
9. Balance between the acids and the alkalines within the body.
10. Can be any two of the following:
 - a. Respiratory
 - b. Renal
 - c. Plasma
11. Can be any three of the following:
 - a. Kidneys
 - b. Heart and blood vessels
 - c. Lungs
 - d. Pituitary gland
 - e. Adrenal gland
 - f. Parathyroid glands

Electrolytes Contained in Body Fluid

	Extracellular Fluid	Intracellular Fluid
Na ⁺⁺	142 mEq/L	0 mEq/L
K ⁺	5 mEq/L	41 mEq/L
Ca ⁺⁺	5 mEq/L	1 mEq/L
Mg ⁺⁺	3 mEq/L	58 mEq/L
Cl ⁻	103 mEq/L	4 mEq/L
HCO ₃ ⁻	28 mEq/L	10 mEq/L
Phosphates	4 mEq/L	75 mEq/L
SO ₄ ⁻⁻	1 mEq/L	2 mEq/L
Glucose	90 mgm %	0 to 20 mgm %
Amino acids	30 mgm %	200 mgm % ?
Cholesterol		
Phospholipids	0.5 gm %	2 to 95 gm %
Neutral fat		
PO ₂	35 mm Hg	20 mm Hg ?
PCO ₂	46 mm Hg	50 mm Hg ?
pH	7.4	7.0

The electrolyte content of body fluids. (From Guy, A. C.: Function of the Human Body. 4th ed. Philadelphia, W. B. Saunders Co., 1974)

Normal Lab Values

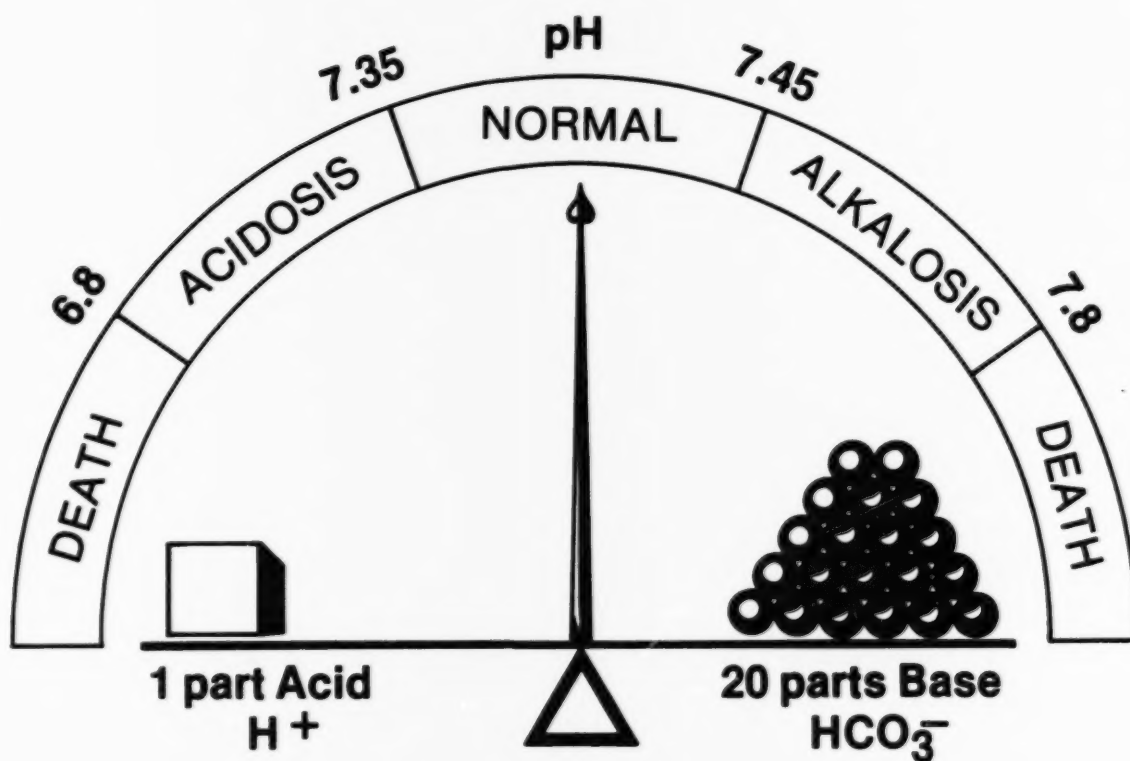
HO 2

Plasma	-----	pH 7.35 - 7.45
		PCO ₂ 35 - 45 mm Hg
		PO ₂ 75 - 100 mm Hg
Sodium (Na)	-----	142 mEq/L
(plasma)		
Potassium (K)	-----	4.5 - 5 mEq/L
(plasma)		
Calcium (Ca +)	-----	4.5 - 5.2 mEq/L
(plasma)		
Phosphate	-----	1.5 - 2.0 mEq/L
Magnesium (Mg)	-----	1.5 - 2.5 mEq/L
Iron (Fe)	-----	50 -150 mg/100 ml
(plasma)		
Bicarbonate (HCO ₃) (plasma)	-----	28 mEq/L
Osmolality (plasma)	-----	280 - 294 mOsm/kg
Trace Elements (plasma):		
• Copper - 100 - 200 mg/100 ml		
• Manganese *		
• Zinc *		
• Cobalt *		
• Halogen Salts *		
• Chlorides - 100 - 106 meq/L		
• Iodides *		
• Fluorides *		
• Arsenic *		
• Aluminum *		
• Silver *		
• Bromide - 0		

*Found only in trace amounts.

These Normal Values May Vary According to Institutions.

The Acid-Base Scale



LESSON PLAN: 2
COURSE TITLE: INTRAVENOUS FLUID THERAPY
UNIT IV FUNDAMENTAL ASPECTS OF FLUID AND ELECTROLYTE
BALANCE

SCOPE OF UNIT:

This unit covers compartments and composition of body fluids, acid-base balance, regulatory mechanisms that maintain acid-base balance, disturbances of electrolyte concentrations, and parenteral fluids and their effects on homeostasis.

INFORMATION TOPIC: X OR DEMONSTRATION:

FLUID AND ELECTROLYTE IMBALANCES
(Lesson Title)

LESSON OBJECTIVES - THE STUDENT WILL BE ABLE TO:

1. Identify the nursing objective in fluid and electrolyte imbalances.
2. Define the eight fluid and electrolyte imbalances.
3. Match the eight fluid and electrolyte imbalances to the correct causes.
4. Match the eight fluid and electrolyte imbalances to the correct symptoms.
5. Identify four acid-base imbalances.
6. List one possible related cause for each acid-base imbalance.

SUPPLEMENTARY TEACHING/LEARNING ITEMS:

1. HO 1: Metabolic Acidosis
2. HO 2: Metabolic Alkalosis
3. HO 3: Respiratory Acidosis
4. HO 4: Respiratory Alkalosis

INFORMATIONAL ASSIGNMENT:

Plumer, Ada Lawrence. Principles and Practice of Intravenous Therapy. 4th ed. Boston: Little, Brown & Co., 1987.

REFERENCES:

Plumer, Ada Lawrence. Principles and Practice of Intravenous Therapy. 4th ed. Boston: Little, Brown & Co., 1987.

Burke, Shirley. The Composition and Function of Body Fluids. St. Louis: C.V. Mosby Co., 1980.

Metheny, Norma M. Fluid and Electrolyte Balance, Nursing Considerations. Philadelphia: J.B. Lippincott Co., 1987.

INTRODUCTION:

Fluid loss or fluid retention is commonly secondary to disease processes and/or trauma with subsequent imbalances of the delicate chemical equilibrium of body fluids and electrolytes.

LESSON PLAN: 2

COURSE TITLE: INTRAVENOUS FLUID THERAPY

UNIT IV FUNDAMENTAL ASPECTS OF FLUID AND ELECTROLYTE
BALANCE

OUTLINE: (Key Points)

- I. Terms Related to Fluid and Electrolyte Imbalances (II-1)
 - A. Hypovolemia - extracellular fluid volume deficit
 - B. Hypervolemia - extracellular fluid volume excess
 - C. Hyponatremia - sodium deficit of extracellular fluid
 - D. Hypernatremia - sodium excess of extracellular fluid
 - E. Hypokalemia - potassium deficit of extracellular fluid
 - F. Hyperkalemia - potassium excess of extracellular fluid
 - G. Hypocalcemia - calcium deficit of extracellular fluid
 - H. Hypercalcemia - calcium excess of extracellular fluid
 - I. Metabolic acidosis - primary deficit in base (bicarbonate)
 - J. Metabolic alkalosis - primary increase in base (bicarbonate)
 - K. Respiratory acidosis - increase in carbonic acid
 - L. Respiratory alkalosis - deficit in carbonic acid
- II. Nursing Objective in Fluid and Electrolyte Imbalances - know the importance of evaluating patient's fluid and electrolytes in order to recognize disturbances and initiate appropriate intervention when indicated (II-2; II-3)
 - A. Evaluation
 1. Monitor patient for signs and symptoms indicative of fluid and electrolyte imbalance.
 2. Recognize deviation from normal in lab values. (II-4)

B. Intervention

1. Report to physician.
2. Apply therapeutic process per physician order.
3. Continue assessment to prevent further complications.

C. Documentation

1. Process
2. Application of therapeutic measures
3. Resolution of problems

III. Fluid Imbalances

A. Hypovolemia - extracellular fluid volume deficit

1. Major causes

- a. Decreased intake of water and electrolytes
- b. Any condition manifested by fluid loss
- c. Intestinal obstruction - water and electrolytes pooled in distended gut
- d. Any person receiving fluid by artificial means (IV therapy, gastrointestinal, etc.) susceptible because the nurse is regulating and there is possibility of human error
- e. Third spacing

2. Signs and symptoms

- a. Dryness of skin and mucous membranes; furrowed tongue
- b. Acute weight loss over short period of time - in excess of 5% caused by loss of ECF -more than 1/2 lb per day; if 1/2 lb a day is lost, it is usually fluid
- c. Decreased urine output
- d. Slow-filling hand veins
- e. Decreased systolic pressure

3. Laboratory data

- a. Elevation of Hct, Hgb, and red cell count
- b. Increased BUN with normal creatinine

- c. Increased urinary specific gravity
 - d. Increased serum osmolality
 - 4. Goal of therapy - provide both water and electrolytes to compensate for loss of both extracellular and intracellular fluid
- B. Hypervolemia - extravellular fluid volume excess
- 2. Major causes
 - a. CHF
 - b. Excessive administration of adrenal cortical hormones
 - c. Excessive ingestion of sodium chloride
 - d. Excessive infusion of isotonic NaCl
 - e. Renal disease
 - f. IV catch-up - IV fluids infused at too fast a rate for patient
 - 2. Signs and symptoms
 - a. Acute weight gain - over short period of time
 - b. Pitting edema
 - c. Moist rales in lungs, SOB
 - d. Distended neck veins
 - e. Bounding, full pulse
 - f. Polyuria if normal renal function
 - 3. Laboratory data
 - a. Hct, Hgb, and red cell count values are below normal because of abnormally large ECF volume
 - b. Decreased BUN
 - c. Decreased osmolality
 - 4. Goal of therapy - calls for removal of excess sodium and water from plasma and interstitial compartments

IV. Electrolyte Imbalances

A. Hyponatremia - sodium deficit of extracellular fluid forcing water into cells

1. Major causes

- a. Excess sweating plus drinking plain H₂O with decreased sodium intake
- b. Excess infusion of carbohydrate and water
- c. Potent diuretics
- d. Induction of labor with oxytocin
- e. Partial drowning in fresh water

2. Signs and symptoms

- a. Fatigue
- b. Anorexia
- c. Muscular weakness or muscle spasms
- d. Apprehension
- e. Hyperactivity of G.I. tract
- f. Convulsions

3. Goal of therapy - reestablish normal osmolality

4. Laboratory data

- a. Plasma sodium less than normal
- b. Specific gravity of urine less than normal
- c. Plasma chloride less than normal
- d. Decreased osmolality

B. Hypernatremia - sodium excess of extracellular fluid drawing water from the cells

1. Major causes

- a. Decreased H₂O intake; concentration of Na greater
- b. Watery diarrhea
- c. Increased intake of sodium

- d. Inhalation of sea water
 - e. Impaired renal function
 - f. Hypertonic saline abortion
 - g. Insufficient amount of water when concentrated tube feedings are used
4. Signs and symptoms
- a. Dry, sticky mucous membranes; rough, red tongue
 - b. Elevated body temperature
 - c. Neck rigidity
 - d. Thirst
 - e. Oliguria, anuria
 - f. Restlessness, excitement, delirium, and convulsions
 - g. Coma
3. Laboratory data
- a. Plasma sodium greater than normal
 - b. Plasma chloride greater than normal
 - c. Urine specific gravity greater than normal
 - d. Increased osmolality
4. Goals of therapy - to dilute the electrolyte concentration excess and at the same time supply maintenance amounts of electrolytes to reestablish normal water for electrolyte ratio
- C. Hypokalemia - potassium deficit of extracellular fluid
1. Major causes
- a. Decreased intake of potassium
 - b. Vomiting, diarrhea
 - c. Draining fistulas
 - c. K-depleting diuretics (furosemides and thiazides, etc.)
 - e. Ulcerative colitis

- f. Burns after third day
- g. Steroid therapy
- 2. Signs and symptoms
 - a. Muscular weakness
 - (1) Skeletal
 - (2) Cardiac
 - (3) Respiratory
 - b. Increased sensitivity to digitalis
 - c. GI tract
 - (1) Anorexia
 - (2) Vomiting
 - (3) Paralytic ileus - extreme response decreased BM and constipation
 - d. Psychiatric
 - (1) Drowsiness
 - (2) Depression
 - (3) Mental clouding
 - (4) General apathy
- 3. Laboratory data
 - a. EKG changes
 - b. Plasma K⁺ less than normal
- 4. Goals of therapy - correct the deficiency and at the same time administer adequate amounts of K⁺ for maintenance needs PO or IV
- D. Hyperkalemia - potassium excess of extracellular fluid
 - 1. Major causes
 - a. Renal disease
 - b. Adrenal insufficiency

- c. Extensive tissue trauma
 - d. Excessive parenteral administration of K⁺
 - e. High-dose potassium penicillin
 - f. High K⁺ intake especially with renal insufficiency
 - g. Rapid transfusion of aged stored blood
 - h. Potassium conserving diuretics (Aldactone, Dyrenium, Amiloride, etc.)
2. Signs and symptoms
 - a. Vague muscle weakness (usually first symptom)
 - b. G.I. hyperactivity (nausea, colic, diarrhea)
 - c. Irritability
 - d. Cardiac arrhythmias
 - e. Parasthesia of face, tongue and extremities
 3. Laboratory data
 - a. EKG changes
 - b. Serum K⁺ elevated
 4. Goals of therapy
 - a. Remove excess K⁺ from the ECF
 - b. Reduce K⁺ intake
- E. Hypocalcemia - calcium deficit of extracellular fluid
1. Major causes
 - a. Massive subcutaneous infections
 - b. Acute pancreatitis
 - c. Inadequate dietary intake
 - d. Excessive administration of citrated blood
 - e. Hypoparathyroidism
 - f. Burns in slough and early granulation stages

- g. Recent correction of acidosis
 - h. Malabsorption syndrome (diarrhea, cystic fibrosis)
 - 2. Signs and symptoms
 - a. Cramping and twitching of muscles
 - b. Tetany / convulsions
 - c. Tingling of circumoral area, fingers and toes
 - d. Hyperactive reflexes
 - e. Respiratory distress
 - 3. Laboratory data
 - a. Plasma calcium decreased
 - b. EKG changes
 - 4. Goals of therapy - reestablish normal plasma level of ionized calcium
- F. Hypercalcemia - calcium excess of extracellular fluid
- 1. Major causes
 - a. Excessive ingestion of calcium
Note: Be aware of overuse of calcium containing antacids.
 - b. Excessive administration of vitamin D
 - c. Hyperparathyroidism
 - d. Pathologic and/or multiple fracture
 - e. Prolonged immobilization
 - f. Renal disease
 - g. Malignant neoplastic disease
 - 2. Signs and symptoms
 - a. Anorexia; nausea and vomiting
 - b. Confusion
 - c. Polydipsia and polyuria

- d. Bone cavitation
 - e. Deep bony pain
 - f. Kidney stones
 - g. Muscle weakness
 - h. Pathologic fractures
 - i. Lethargy
 - j. Cardiac arrest in hypercalcemic crisis
3. Laboratory data
- a. X-ray reveals widespread cavitation of bones
 - b. Plasma calcium increased
 - c. EKG changes
4. Goal of therapy - decrease plasma Ca^{++} level to normal

V. Acid-Base Disturbances

A. Metabolic acidosis - primary deficit in base (bicarbonate) (HCO_3^-)

1. Possible causes - any condition flooding ECF with acid metabolites
- a. Diabetic ketoacidosis
 - b. Uremic acidosis
 - c. Ingestion of toxins or drugs
 - d. Lactic acidosis
 - e. Starvation ketoacidosis
 - f. Diarrhea
 - g. Renal tubular acidosis
 - h. Hyperalimentation
 - i. Acidifying drugs
2. Signs and symptoms
- a. Hyperventilation
 - b. Shortness of breath on exertion

- c. Weakness
 - d. Disorientation
 - e. Coma
 - 3. Laboratory findings
 - a. Urine pH often below normal
 - b. Plasma pH below 7.35
 - c. Plasma bicarbonate below normal
 - d. PCO_2 below normal
 - e. PO_2 normal
 - 4. Related considerations
 - a. Body correction, both renal and pulmonary
 - b. Often associated with potassium excess
 - c. If not reversed, can result in death (11-5)
- B. Metabolic alkalosis - primary increase in base (bicarbonate) (HO 2)
- 1. Possible causes
 - a. Administration of potent diuretics
 - b. Vomiting and gastric suction
 - c. Excessive intake of alkalis
 - d. Abrupt relief of chronically high CO_2 level in plasma
 - 2. Signs and symptoms
 - a. Dizziness
 - b. Numbness and tingling of extremities
 - c. Hypertonicity of muscles
 - d. Slow, shallow respirations with periods of apnea (compensatory)
 - e. Bradycardia
 - f. Convulsions

3. Laboratory findings

- a. Urine pH sometimes above normal
- b. Plasma pH above 7.45
- c. Plasma bicarbonate above normal
- d. PCO_2 above normal

4. Related considerations

- a. Body correcton, both renal and pulmonary
- b. Often associated with potassium deficite
- c. If not reversed, can result in death

C. Respiratory acidosis - increase in carbonic acid (H_2CO_3)

I. Possible causes

a. Hypoventilation

- (1) Acute pulmonary edema
- (2) Atelectasis
- (3) Pneumothorax
- (4) Hemothorax
- (5) Aspiration of foreign body
- (6) Medication overdose
- (7) Cardiac arrest
- (8) Severe pneumonia
- (9) Laryngeal spasm
- (10) Croup
- (11) Hyaline membrane disease
- (12) Improperly regulated mechanical ventilator (II-6)

b. COPD (chronic obstructive pulmonary disease)

- (1) Emphysema
- (2) Black lung
- (3) Asthma

2. Signs and Symptoms - variable between acute and chronic
 - a. Elevated pulse, respirations, and blood pressure
 - b. Impaired respirations (may be detectable)
 - c. Disorientation
 - d. Weakness
 - e. Headache
 - f. Convulsions
 - g. Coma
 3. Laboratory findings
 - a. Urine pH below normal
 - b. Plasma pH below 7.35
 - c. Plasma bicarbonate normal or slightly above normal
 - d. PCO_2 above normal
 4. Related problems
 - a. Body compensation slowed as dependent solely on kidneys
 - b. If not reversed, can result in death
- D. Respiratory alkalosis - deficit of carbonic acid (HO 4)
- I. Possible cause - hyperventilation
 - a. Extreme anxiety
 - b. Hypoxemia
 - c. High fever
 - d. Excessive mechanical ventilation (II-6)
 - e. Gram-bacteremia
 - f. Early salicylate intoxication
 - g. Medullary lesions
 - h. Pulmonary emboli

2. Signs and Symptoms

- a. Deep, rapid breathing
- b. Tetany
- c. Paresthesia
- d. Tingling and numbness of extremities and circumoral region
- e. Precordial pain
- f. Nausea and vomiting
- g. Epigastric pain
- h. Lightheadedness
- i. Inability to concentrate
- j. Tinnitus
- k. Blurred vision
- l. Diaphoresis
- m. Dry mouth
- n. Convulsions

3. Laboratory findings

- a. Plasma pH above 7.45
- b. PCO₂ below normal
- c. Plasma bicarbonate may be unchanged initially, below normal if chronic

4. Related considerations - if not reversed, may result in death

VI. Summary and Conclusion

- A. Terms related to fluid and electrolyte imbalances
- B. Nursing objective in fluid and electrolyte imbalances
- C. Fluid imbalances
- D. Electrolyte imbalances
- E. Acid-base disturbances

LESSON PLAN: 2
COURSE TITLE: INTRAVENOUS FLUID THERAPY
UNIT IV FUNDAMENTAL ASPECTS OF FLUID AND ELECTROLYTE
BALANCE

INTERACTION ITEMS:

1. Why is it necessary to know the definitions of terms?
2. Why must a nurse know the cause of an electrolyte imbalance?
3. What is the importance of nurses knowing and recognizing the signs symptoms of electrolyte imbalances?
4. What is the importance of lab data knowledge to nurses?
5. Why should a nurse know the goals of therapy for acid-base disturbances?
6. Patients with mechanical ventilators and/or respiratory distress should be observed carefully for what type of imbalances?

CLASSROOM, LABORATORY, OR OTHER ACTIVITIES:

LESSON PLAN: 2

COURSE TITLE: INTRAVENOUS FLUID THERAPY

UNIT IV FUNDAMENTAL ASPECTS OF FLUID AND ELECTROLYTE
BALANCE

EVALUATION ITEMS:

1. Identify the nursing objective in fluid and electrolyte imbalances.

2. Define the eight fluid and electrolyte imbalances.

- a. Hypovolemia:
- b. Hypervolemia:
- c. Hyponatremia:
- d. Hypernatremia:
- e. Hypokalemia:
- f. Hyperkalemia:
- g. Hypocalcemia:
- h. Hypercalcemia:

Match each of the following fluid and electrolyte imbalance conditions to the correct cause(s):

- | | |
|------------------|------------------|
| a. Hypokalemia | e. Hyponatremia |
| b. Hyperkalemia | f. Hypercalcemia |
| c. Hypovolemia | g. Hypervolemia |
| d. Hypernatremia | h. Hypocalcemia |

- _____ 3. Intestinal obstruction, decreased H₂O and electrolytes intake, fluid by artificial means, third spacing
- _____ 4. CHF, IV catch-up, excessive administration of adrenal cortical hormones

- _____ 5. Impaired renal function, inhalation of sea water, decreased H₂O intake, hypertonic saline abortion
- _____ 6. Potent diuretics, induction of labor with oxytocic, excessive sweating and drinking plain H₂O, partial drowning in fresh water
- _____ 7. K-depleting diuretics, ulcerative colitis, burns after third day, steroid therapy
- _____ 8. Extensive tissue trauma, rapid transfusion of aged stored blood, renal disease, high dose potassium penicillin
- _____ 9. Acute pancreatitis, hypoparathyroidism, excessive administration of citrated blood, burns in early granulation stage
- _____ 10. Excessive ingestion of calcium, hyperparathyroidism, pathologic and/or multiple fractures, prolonged immobilization

Match each of the following fluid and electrolyte imbalances to the correct symptom(s):

- a. Hypokalemia
- b. Hyperkalemia
- c. Hypovolemia
- d. Hyponatremia

- e. Hyponatremia
- f. Hypercalcemia
- g. Hypervolemia
- h. Hypocalcemia

- _____ 11. Kidney stones, deep bony pain, bone cavitation, polydipsia/polyuria, pathologic fractures
- _____ 12. Vague muscle weakness, G.I. Hyperactivity, cardiac arrhythmias, parasthesia of tongue
- _____ 13. Fatigue, anorexia, apprehension, muscular weakness, convulsions
- _____ 14. Dry, sticky mucous membranes, thirst, elevated body temperature, rough, red, dry skin, neck rigidity
- _____ 15. Dryness of skin and mucous membranes, acute weight loss, furrows in tongue, decreased urine output, slow-filling hand veins
- _____ 16. Paralytic ileus, heightened sensitivity to digitalis, generalized weakness
- _____ 17. Acute weight gain over short period of time, pitting edema, moist rales in lungs, distended neck veins
- _____ 18. Abdominal cramps, tetany, tingling of circumoral area, muscle cramping and twitching

19. Identify four acid-base imbalances.

- a. _____ - increase in carbonic acid
- b. _____ - primary increase in base (bicarbonate)
- c. _____ - primary deficit in base (bicarbonate)
- d. _____ - deficit of carbonic acid

20. List one possible related cause for each acid-base imbalance.

- a.
- b.
- c.
- d.

LESSON PLAN: 2
COURSE TITLE: INTRAVENOUS FLUID THERAPY
UNIT IV FUNDAMENTAL ASPECTS OF FLUID AND ELECTROLYTE
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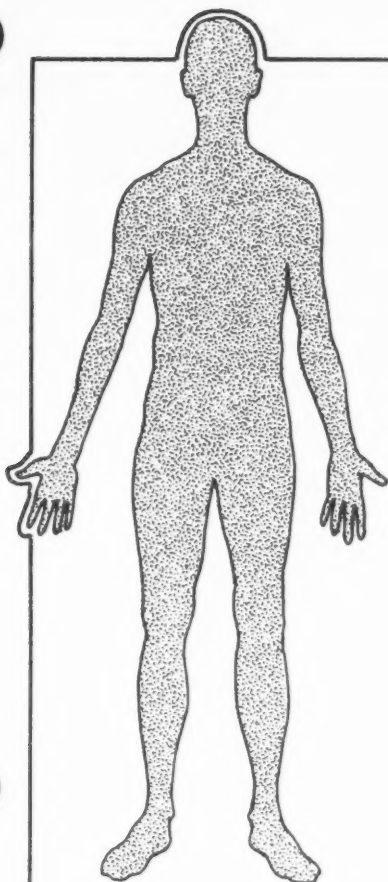
ANSWERS TO EVALUATION ITEMS:

1. Know the importance of evaluating the patient's fluid and electrolytes in order to recognize disturbances and initiate appropriate intervention when indicated.
2.
 - a. Hypovolemia: extracellular fluid volume deficit
 - b. Hypervolemia: extracellular fluid volume excess
 - c. Hyponatremia: sodium deficit of extracellular fluid
 - d. Hypernatremia: sodium excess of extracellular fluid
 - e. Hypokalemia: potassium deficit of extracellular fluid
 - f. Hyperkalemia: potassium excess of extracellular fluid
 - g. Hypocalcemia: calcium deficit of extracellular fluid
 - h. Hypercalcemia: calcium excess of extracellular fluid
3. c
4. g
5. d
6. e
7. a
8. b
9. h
10. f
11. f
12. b
13. e
14. d
15. c
16. a
17. g
18. h
19.
 - a. Respiratory acidosis
 - b. Metabolic alkalosis
 - c. Metabolic acidosis
 - d. Respiratory alkalosis
20. The student may list any one of the following causes for each condition:
 - A. Metabolic acidosis - any condition flooding ECF with metabolites
 1. Diabetic ketoacidosis
 2. Uremic acidosis
 3. Ingestion of toxins or drugs
 4. Lactic acidosis
 5. Starvation ketoacidosis
 6. Diarrhea
 7. Renal tubular acidosis
 8. Hyperalimentation
 9. Acidifying drugs

- B. Metabolic alkalosis
 - 1. Administration of potent diuretics
 - 2. Vomiting and gastric suction
 - 3. Excessive intake of alkalis
 - 4. Abrupt relief of chronically high CO₂ level in plasma
- C. Respiratory acidosis
 - 1. Hypoventilation
 - a. Acute pulmonary edema
 - b. Atelectasis
 - c. Pneumothorax
 - d. Hemothorax
 - e. Aspiration of foreign body
 - f. Medication overdose
 - g. Cardiac arrest
 - h. Severe pneumonia
 - i. Laryngeal spasm
 - j. Croup
 - k. Hyaline membrane disease
 - l. Improperly regulated mechanical ventilator
 - 2. COPD (chronic obstructive pulmonary disease)
 - a. Emphysema
 - b. Black lung
 - c. Asthma
- D. Respiratory alkalosis - hyperventilation
 - 1. Extreme anxiety
 - 2. Hypoxemia
 - 3. High fever
 - 4. Excessive Mechanical ventilation
 - 5. Gram-bacteremia
 - 6. Early salicylate intoxication
 - 7. Medullary lesions
 - 8. Pulmonary emboli

Metabolic Acidosis

Primary Deficit in Base (Bicarbonate)



PRECEDING EVENTS

- Flooding of ECF with acid, metabolites
- Diabetic ketoacidosis
- Uremic acidosis
- Ingestion of toxins or drugs (e.g., salicylates, ethanol [ethyl alcohol], methanol [methyl alcohol], formic acid, paraldehyde, boric acid, ethylene glycol, oxalic acid)
- Lactic acidosis
- Starvation ketoacidosis
- Diarrhea
- Renal tubular acidosis
- Acidifying drugs
- Hyperalimentation

SIGNS AND SYMPTOMS

- Shortness of breath on exertion
- Hyperventilation
- Weakness
- Disorientation
- Coma

LABORATORY FINDINGS

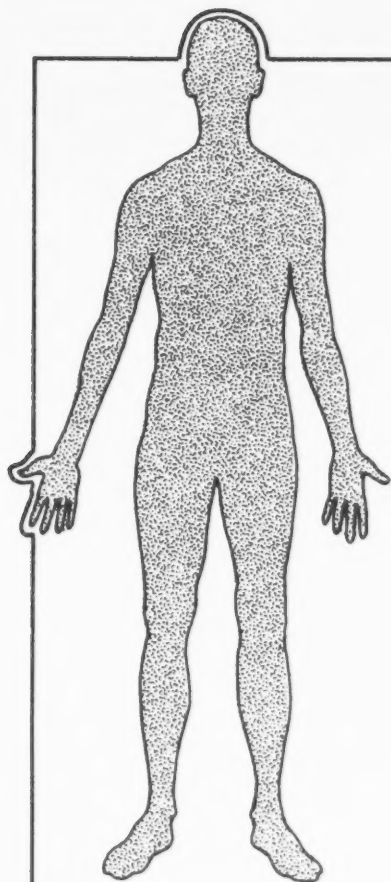
- Urine pH often below 6
- Plasma pH below 7.35
- Plasma bicarbonate below 24 mEq/liter
- P_{CO_2} below 40 mm Hg
- P_{O_2} 80-90 mm Hg

RELATED CONSIDERATIONS

- Body correction, both renal and pulmonary
- Often associated with potassium excess
- If not reversed, can result in death

Metabolic Alkalosis

Primary Increase in Base (Bicarbonate)



PRECEDING EVENTS

- Loss of chloride, with compensatory bicarbonate rise
- Excessive intake of alkalis

SIGNS AND SYMPTOMS

- Numbness and tingling of extremities
- Hypertonicity of muscles
- Slow, shallow respiration, with periods of apnea (compensatory)
- Bradycardia
- Dizziness
- Convulsions

LABORATORY FINDINGS

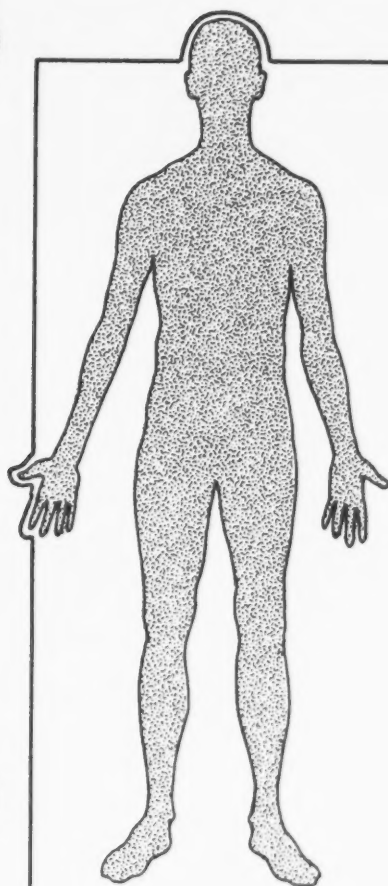
- Urine pH sometimes above 7
- Plasma pH above 7.45
- Plasma bicarbonate above 24 mEq/liter
- Pco₂ above 40 mm Hg

RELATED CONSIDERATIONS

- Body correction, both renal and pulmonary
- Often associated with potassium deficit
- If not reversed, can result in death

Respiratory Acidosis

Increased Carbonic Acid



PRECEDING EVENTS

- Hypoventilation and COPD

SIGNS AND SYMPTOMS

(Note: variable between acute and chronic)

- Impaired respiration
- Disorientation
- Weakness
- Headache
- ↑Pulse, ↑Resp, ↑B/P
- Convulsions
- Coma

LABORATORY FINDINGS

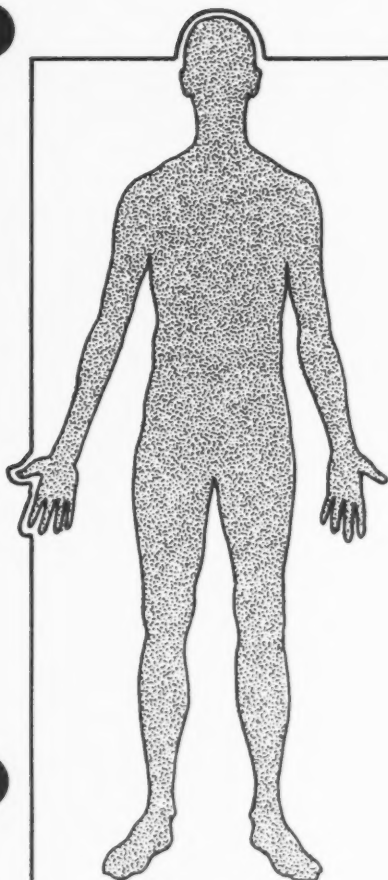
- Urine pH below 6
- Plasma pH below 7.35
- Plasma bicarbonate above 24 mEq/liter
- P_{CO_2} above 40 mm Hg

RELATED CONSIDERATIONS

- Body compensation must depend on kidneys alone, therefore slow
- If not reversed, may result in death

Respiratory Alkalosis

Deficit of Carbonic Acid



PRECEDING EVENTS

- Hyperventilation from any cause

SIGNS AND SYMPTOMS

- Deep, rapid breathing (hyperventilation)
- Tetany (calcium ionization decreased)
- Paresthesia
- Tingling and numbness of extremities and circumoral region
- Inability to concentrate
- Tinnitus
- Blurred vision
- Diaphoresis
- Dry mouth
- Precordial pain
- Nausea and vomiting
- Epigastric pain
- Lightheadedness
- Coma

LABORATORY FINDINGS

- Urine pH above 7
- Plasma pH above 7.45
- Plasma bicarbonate may be unchanged initially, below normal if chronic
- P_{CO_2} below 40 mm Hg

RELATED CONSIDERATIONS

- Body compensation must depend on kidneys alone, therefore slow
- If not reversed, may result in death

LESSON PLAN: 3
COURSE TITLE: INTRAVENOUS FLUID THERAPY
UNIT IV FUNDAMENTAL ASPECTS OF FLUID AND ELECTROLYTE
BALANCE

SCOPE OF UNIT:

This unit covers compartments and composition of body fluids, acid-base balance, regulatory mechanisms that maintain acid-base balance, disturbances of electrolyte concentrations, and parenteral fluids and their effects on homeostasis.

INFORMATION TOPIC: X OR DEMONSTRATION:

PARENTERAL FLUIDS
(Lesson Title)

LESSON OBJECTIVES - THE STUDENT WILL BE ABLE TO:

1. Match the following terms to correct definitions:
 - a. Hypertonic
 - b. Isotonic
 - c. Hypotonic
 - d. Infusion
 - e. Ketones
2. List three official requirements of intravenous fluids.
3. Identify specific IV fluids and indications for use.
4. Identify systemic dangers in administration of specific intravenous fluids.

SUPPLEMENTARY TEACHING/LEARNING ITEMS:

1. HO 1: Specific Intravenous Fluids (Student Work Sheet)
2. HO 2: Intravenous Fluid Reference Chart
3. Samples of intravenous fluids

INFORMATIONAL ASSIGNMENT:

Plumer, Ada Lawrence. Principles and Practice of Intravenous Therapy. 4th ed. Boston: Little, Brown & Co., 1987.

REFERENCES:

Plumer, Ada Lawrence. Principles and Practice of Intravenous Therapy. 4th ed. Boston: Little, Brown & Co., 1987.

Metheny, Norma M. Fluid and Electrolyte Balance, Nursing Considerations. Philadelphia: J.B. Lippincott Co., 1987.

INTRODUCTION:

A knowledge of parenteral fluids is essential if the patient is to be protected from the rapid and critical changes in fluid and electrolyte balance that may be caused by such infusions.

LESSON PLAN: 3
COURSE TITLE: INTRAVENOUS FLUID THERAPY
UNIT IV FUNDAMENTAL ASPECTS OF FLUID AND ELECTROLYTE
BALANCE

OUTLINE: (Key Points)

- I. Terms and Definitions
 - A. Hypertonic - increase in osmotic pressure drawing fluid from cells
 - B. Hypotonic - decreased osmotic pressure causing fluids to invade the cells
 - C. Infusion - an amount of fluid designated for parenteral use, to be administered over a specific period of time
 - D. Isotonic - a solution which has the same osmotic pressure externally as that found across the semipermeable membrane of the cell
 - E. Ketones - metabolic by-products of normal fat metabolism
- II. Official Requirements of Intravenous Fluids
 - A. Free of defects and particulate matter (mobile, undissolved substances)
 - I. Examine container integrity. (II-1)
 - a. Squeeze bags for leaks.
 - b. Hold glass containers up to light for reflection of light which would indicate chipping or cracking.
 2. Examine container against a light and dark background for cloudiness or particles.
 - B. pH - indicates hydrogen ion concentration of free acid activity
 1. Usually slightly acid
 2. pH 3.5 - 6.2
 - C. Tonicity - concentration in relation to blood plasma (II-2)
 1. When infused into the circulation, has a direct effect on fluid and electrolyte metabolism
 - a. Hypertonic can cause cellular dehydration.

- b. Hypotonic can cause water intoxication.
 - c. Isotonic fluids increase extracellular fluid volume which can result in circulatory overload.
2. Affects choice of veins - hyperosmolar needs large veins
 3. Affects rate of infusion - hypertonic should not infuse rapidly

III. Specific Fluids (HO 1)

INSTRUCTOR NOTE: Distribute HO 1 as a note-taking aid for students.

A. Dextrose in water

1. Isotonic - 5% is isotonic in container but becomes hypotonic in the body
2. pH 3.5 - 6.5
3. Calories - 1 liter D₅/W = 170 calories
4. Available in 2.5, 5, 10, 20, and 50% concentration, and in 1000, 500, 250, 100, 50 ml sizes
5. Metabolic effect
 - a. Provides calories for essential energy
 - b. Glucose is converted into glycogen by synthesis in the liver, resulting in improved hepatic function
 - c. Spares body protein
 - d. Prevents ketosis or excretion of organic acid which occurs when fat is burned by the body without an adequate supply of glucose
 - e. When deposited intracellularly in the liver as glycogen, dextrose causes a shift of potassium from the extracellular to the intracellular fluid compartments
6. Indications for use
 - a. Dehydration
 - (1) Rapidly metabolized, leaving the water
 - (2) Water decreases the osmotic pressure of the blood plasma and invades the cell; provides immediately-available water to dehydrated tissues
 - b. Hyponatremia - to decrease the concentration of sodium if patient not fluid overloaded

- c. Vehicle for drug administration
- d. Nutrition - calories for energy
- e. Hyperkalemia - with insulin causes anabolism (build-up of body cells) which results in a shift of K from ECF to ICF, thereby lowering serum K concentration

7. Systemic dangers

- a. Hypokalemia
- b. Dehydration
- c. Hyperinsulinism - carbohydrates being infused, pancreas responds releasing insulin; termination of infusion leaves insulin in the body
- d. Water intoxication
- e. Increased intracranial pressure - due to increased cerebral edema

8. Contraindications - do not give with blood or blood products, would result in hemolysis of blood cells

B. Isotonic sodium chloride solution - NS

- 1. Isotonic
- 2. pH 4.5 - 7.0
- 3. Available in 1000, 500, 250, and 150, 100, 50, and 25 ml sizes
- 4. Indications for use
 - a. Extracellular fluid replacement when chloride loss has been relatively greater or equal to sodium loss
 - b. Treatment of metabolic alkalosis in presence of fluid loss
 - c. Sodium depletion
 - d. Initiation and termination of blood transfusions
- 5. Systemic dangers
 - a. Acidosis
 - b. Hypernatremia
 - c. Hypokalemia
 - d. Circulatory overload

- C. Isotonic saline and 5% dextrose - D₅/NS
 - 1. Hypertonic in container; isotonic in body
 - 2. pH 3.5-6.0
 - 3. Available in 1000, 500, 250, and 150 cc sizes
 - 4. Metabolic effects
 - a. Helps prevent formation of ketone bodies
 - b. Helps prevent catabolism and therefore loss of K and intracellular water
 - 5. Indications for use
 - a. Temporary treatment of circulatory insufficiency and shock due to hypovolemia in the immediate absence of a plasma expander
 - b. Concurrent early treatment with plasma or albumin for replacement of loss due to burns
 - c. Early treatment of adrenocortical insufficiency
 - 6. Systemic dangers
 - a. Acidosis
 - b. Hypernatremia
 - c. Hypokalemia
 - d. Circulatory overload
- D. 10% dextrose in normal saline - D₁₀/NS
 - 1. The combination of dextrose in isotonic NaCl results in a hypertonic solution.
 - 2. pH 3.5-6.0
 - 3. Available in 1000 and 500 cc sizes
 - 4. Indications for use
 - a. Nutrient - increases calories
 - b. Electrolyte replenisher - Na and Cl
 - c. Promotes diuresis

5. Systemic dangers
 - a. Hypernatremia
 - b. Acidosis
 - c. Circulatory overload
 6. Administration - need large vein due to hypertonicity; can damage tissue
- E. Hypertonic NaCl (3% or 5%)
1. Indications
 - a. Severe dilutional hyponatremia (water intoxication)
 - b. Severe sodium depletion
 - c. To dilute certain chemotherapeutic agents
 2. Systemic danger - circulatory overload if not administered slowly
- F. Hypotonic NaCl in water (0.45% NaCl in H₂O)
1. Indications for use
 - a. Electrolyte replenisher
 - b. Hydration
 - c. To assess renal function
 - d. When fluid tolerance is in question
 2. Systemic danger - circulatory overload
- G. Hydrating fluids
1. Solutions consisting of dextrose with hypotonic saline provide more water than is required for excretion of salt
 - a. 2.5% dextrose in 0.45% saline
 - b. 5% dextrose in 0.45% saline
 - c. 5% dextrose in 0.2% saline
 2. Indications for use
 - a. Hydrating fluids - assess kidney function before electrolyte replacement and maintenance are initiated

- b. Hydration of med/surg patient
 - c. Promotion of diuresis in dehydrated patient
- 3. Systemic danger - circulatory overload in:
 - a. Presence of edema
 - b. Cardiac disease
 - c. Renal disease
 - d. Liver disease
- H. Hypotonic multiple electrolyte solution - Plasmalyte M
 - 1. Hypotonic - provide water for urinary and metabolic needs
 - 2. Indications for use - best maintenance electrolyte solution
 - 3. Systemic dangers
 - a. Hyperkalemia with decreased renal function
 - b. Water intoxication - must monitor daily weights
- I. Isotonic multiple electrolyte fluids - Ringer's lactate
 - 1. Indications for use
 - a. Great fluid and electrolyte loss
 - (1) Vomiting
 - (2) Diarrhea
 - (3) Diuresis
 - (4) Hemorrhage
 - (5) Burns
 - b. Mild acidosis
 - 2. Systemic danger - circulatory overload
- J. Alkalizing fluids
 - 1. Types of solutions
 - a. 1/6 molar isotonic sodium lactate; pH 6.0-7.3
 - b. 1/6 molar sodium bicarbonate; pH 7.0-8.0

- c. Hypertonic sodium bicarbonate; pH 7.5
- d. Sodium bicarbonate - isotonic
 - (1) Used in early severe acidosis
 - (2) 500 cc in 1.5% solution
 - (3) Infuse slowly
 - (4) Dangers - hypocalcemic tetany
- 2. Indication for use - to treat metabolic acidosis
- K. Acidifying infusion
 - 1. Normal saline
 - 2. Ammonium chloride
 - a. Isotonic 0.9% ammonium chloride injections
 - b. Hypertonic 2.14% ammonium chloride injections
 - c. pH 4.0-6.0
 - 3. Indications for use - severe metabolic alkalosis due to
 - a. Loss of gastric secretion
 - b. Pyloric stenosis
 - 4. Systemic dangers
 - a. Irregular respirations
 - b. Bradycardia
 - c. Twitching
 - 5. Administration guidelines
 - a. 2.14% for adults
 - b. 0.9% for children
 - c. Very slow rate for liver to metabolize the ammonium ions
 - 6. Precautions
 - a. Do not give to patients with severe hepatic disease.
 - b. Do not give to patients with renal failure.

- c. Do not give to patients with high ammonium level.

IV. Summary and Conclusion

- A. Terms and definitions
- B. Official requirements of intravenous fluids
- C. Specific fluids

LESSON PLAN: 3

COURSE TITLE: INTRAVENOUS FLUID THERAPY

UNIT IV FUNDAMENTAL ASPECTS OF FLUID AND ELECTROLYTE
BALANCE

INTERACTION ITEMS:

1. Why must you confirm the integrity of the container?
2. Why is it important to have a knowledge of the tonicity of parenteral fluids?

CLASSROOM, LABORATORY, OR OTHER ACTIVITIES:

1. Examine IV fluid containers.
2. Have students complete HO I (Specific Intravenous Fluids).

LESSON PLAN: 3

COURSE TITLE: INTRAVENOUS FLUID THERAPY

UNIT IV FUNDAMENTAL ASPECTS OF FLUID AND ELECTROLYTE
BALANCE

EVALUATION ITEMS:

Match the following terms to correct definitions by placing the appropriate letter in the space provided.

- | | | |
|-------|---------------|---|
| _____ | 1. Hypertonic | a. An amount of fluid designated for parenteral use to be administered over a specific period of time |
| _____ | 2. Hypotonic | |
| _____ | 3. Infusion | b. Solution with same osmotic pressure as intracellular fluid |
| _____ | 4. Isotonic | c. Increase in osmotic pressure drawing fluid from cells |
| _____ | 5. Ketones | d. Decrease in osmotic pressure forcing fluid into cells |
| | | e. Metabolic by-products of normal fat metabolism |

6. List three official requirements of intravenous fluids.

- a.
- b.
- c.

Place a "T" in the space provided if the statement is true, or an "F" if the statement is false.

- _____ 7. Dextrose in water should never be administered with blood or blood components.
- _____ 8. Acidosis, hypernatremia, hypokalemia and circulatory overload are dangers of administering isotonic sodium chloride and isotonic saline with 5% dextrose.
- _____ 9. 10% dextrose in normal saline must be administered in a large vein because the hypertonicity of the solution can damage tissue.
- _____ 10. Hypertonic NaCl (3-5%) must be administered slowly to prevent pulmonary edema.
- _____ 11. Hydrating fluids may cause water intoxication in the presence of edema; cardiac, liver, and renal disease.
- _____ 12. Hypotonic saline should be administered slowly to prevent pulmonary edema.
- _____ 13. Patients with decreased renal function may develop hyperkalemia when infused with a hypotonic multiple electrolyte fluid.
- _____ 14. The isotonic multiple electrolyte fluid, Ringer's lactate, may cause metabolic acidosis or alkalosis in liver disease.
- _____ 15. Hypocalcemic tetany is a danger when using alkalyzing intravenous fluids.
- _____ 16. Irregular respirations, bradycardia and twitching are dangers when infusing acidifying fluids.

LESSON PLAN: 3

COURSE TITLE: INTRAVENOUS FLUID THERAPY

UNIT IV FUNDAMENTAL ASPECTS OF FLUID AND ELECTROLYTE
BALANCE

ANSWERS TO EVALUATION ITEMS:

1. c
2. d
3. a
4. b
5. e
6. a. Free of particulate matter
b. pH usually slightly acid
c. Tonicity stable - in relation to blood plasma
7. T
8. T
9. T
10. T
11. T
12. T
13. T
14. F
15. T
16. T

SPECIFIC INTRAVENOUS FLUIDS

1. Dextrose in water - D₅W
 - A. Tonicity
 - B. pH
 - C. Calories
 - D. Metabolic effects
 - E. Indications for use
 - F. Systemic dangers
 - G. Contraindications
2. Isotonic sodium chloride - NS
 - A. Tonicity
 - B. pH
 - C. Indications for use
 - D. Systemic dangers
3. Isotonic saline with dextrose - D₅NS
 - A. Tonicity
 - B. pH
 - C. Metabolic effects
 - D. Indications for use
 - E. Systemic dangers
4. 10% dextrose in normal saline - D₁₀NS
 - A. Tonicity
 - B. pH
 - C. Indications for use
 - D. Systemic dangers
 - E. Administration

5. Hypertonic sodium chloride infusion (3% or 5%)
 - A. Indications for use
 - B. Systemic danger
6. Hypotonic sodium chloride in water - 0.45 sodium chloride in water
 - A. Indications for use
 - B. Systemic dangers
7. Dextrose with hypotonic saline (hydrating fluids)
 - A. Types of solutions
 - B. Indications for use
 - C. Systemic dangers
8. Hypotonic multiple electrolyte solution - Plasmalyte M
 - A. Indications for use
 - B. Systemic dangers
9. Isotonic multiple electrolyte fluids
 - A. Indications for use
 - B. Systemic dangers
10. Alkalizing fluids
 - A. Types of solutions
 - B. Indication for use
11. Acidifying infusion
 - A. Types
 - B. Indications for use
 - C. Systemic dangers
 - D. Administration guidelines
 - E. Precautions

INTRAVENOUS FLUID REFERENCE CHART

Type of Fluid	Nonelectrolyte Constituents	Calories/ Liter	pH	Tonicity	Comment
Dextrose in Water Solutions 5% Dextrose in Water 10% Dextrose in Water 20% Dextrose in Water 50% Dextrose in Water	Dextrose Dextrose Dextrose Dextrose	170 340 680 1,700	4.8 4.7 4.8 4.6	Isotonic (252 mOsm/L) Hypertonic (505 mOsm/L) Hypertonic (1,010 mOsm/L) Hypertonic (2,525 mOsm/L)	Does not replace or correct fluid deficits. Hypertonic solutions irritate the veins and act as osmotic diuretics, thus increasing body fluid loss. Dextrose solutions mixed with blood infusions cause hemolysis of red cells.
Dextrose in Saline Solutions 5% Dextrose and 0.2% Sodium Chloride 5% Dextrose and 0.45% Sodium Chloride 5% Dextrose and 0.9% Sodium Chloride 10% Dextrose and 0.9% Sodium Chloride	Dextrose Dextrose Dextrose Dextrose	170 170 170 340	4.6 4.6 4.4 4.8	Isotonic (320 mOsm/L) Hypertonic (406 mOsm/L) Hypertonic (559 mOsm/L) Hypertonic (812 mOsm/L)	Provides Calories, Water, Na ⁺ and Cl ⁻ Used to treat temporary hypovolemia and to promote diuresis in dehydrated patients.
Saline Solutions 0.45% Sodium Chloride 0.9% Sodium Chloride 3% Sodium Chloride 5% Sodium Chloride			5.9 6.0 6.0 6.0	Hypotonic (154 mOsm/L) Isotonic (308 mOsm/L) Hypertonic (1,026 mOsm/L) Hypertonic (1,710 mOsm/L)	Supplies daily salt and water requirements. Widely used as a routine electrolyte replacement solution even though it supplies only Na ⁺ and Cl ⁻ . These are supplied in excess of normal plasma levels. Used for correction of severe salt depletion only.
Multiple Electrolyte Solutions Ringer's Solution Lactated Ringer's Solution 5% Dextrose in Lactated Ringer's 10% Dextrose in Lactated Ringer's	 Dextrose Dextrose	 9 179 349	6.0 6.5 5.1 4.9	Isotonic (309 mOsm/L) Isotonic (273 mOsm/L) Hypertonic (524 mOsm/L) Hypertonic (776 mOsm/L)	Replaces K ⁺ and C ⁺⁺ besides Na ⁺ and Cl ⁻ ; Cl ⁻ is in excess of normal plasma Cl ⁻ level. Electrolyte concentration closely resembles ECF. Used to replace ECF deficits and losses from vomiting or gastric suction. Dextrose provides calories.

INTRAVENOUS FLUID REFERENCE CHART

Type of Fluid	Nonelectrolyte Constituents	Calories/ Liter	pH	Tonicity	Comment
Plasma Substitutes 10% Dextran 40 in 5% Dextrose 10% Dextran 40 in 0.9% Sodium Chloride	Dextrose	170	4.7	Isotonic (252 mOsm/L)	Raises osmotic pressure of blood drawing interstitial fluid into vessels. Give Dextran carefully to patients with heart or renal disease.
		0	5.1	Isotonic (308 mOsm/L)	
Alcohol Solutions 5% Alcohol in 5% Dextrose	Dextrose Alcohol	525	4.6	Hypertonic (1,114 mOsm/L)	Provides calories. Has depressant and diuretic effects.
Amino Acid Solutions 8.5% Amino Acids	Essential and Nonessential Amino Acids	950	6.4	Hypertonic (950 mOsm/L)	Amino acid preparations are available in varying percentages and electrolyte content. Supplies proteins for tissue repair and helps to correct negative nitrogen balance states.
Fat Emulsions Intralipid, Liposyn, Travamulsion 10% Intralipid, Liposyn, Travamulsion 20%	Fat Emulsion	550/500ml.	5.5-9	Isotonic (280-300 mOsm/L)	Excellent source of calories and essential fatty acids. Contraindicated in patients with disorders of fat metabolism or liver damage.
	Fat Emulsion	1,000/500ml.	5.5-9	Isotonic (330-340 mOsm/L)	

NOTE: This chart is not meant to depict all the intravenous fluids that are commercially available today, but rather, is meant to illustrate the fluids that are most commonly used in the provision of intravenous therapy.

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LESSON PLAN: 1
COURSE TITLE: INTRAVENOUS FLUID THERAPY
UNIT V RECOGNITION AND PREVENTION OF IV THERAPY
RELATED COMPLICATIONS

SCOPE OF UNIT:

This unit will present the signs and symptoms of both systemic and local IV therapy complications. It will include preventive measures and nursing interventions should such complications occur.

INFORMATION TOPIC: X OR DEMONSTRATION:

LOCAL AND SYSTEMIC COMPLICATIONS
(Lesson Title)

LESSON OBJECTIVES - THE STUDENT WILL BE ABLE TO:

1. Define terms associated with local and systemic complications.
2. Match symptoms associated with the following complications:
 - a. Pyrogenic reaction
 - b. Pulmonary embolus
 - c. Air embolism
 - d. Pulmonary edema
 - e. Speed shock
3. Match nursing interventions to the following complications:
 - a. Pyrogenic reaction
 - b. Pulmonary embolus
 - c. Air embolism
 - d. Pulmonary edema
 - e. Speed shock

SUPPLEMENTARY TEACHING/LEARNING ITEMS:

1. HO 1: Air Embolism
2. HO 2: Positioning the Patient with Air Embolism

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INFORMATIONAL ASSIGNMENT:

Plumer, Ada Lawrence. Principles and Practice of Intravenous Therapy. 4th ed. Boston: Little, Brown & Co., 1987.

REFERENCES:

Plumer, Ada Lawrence. Principles and Practice of Intravenous Therapy. 4th ed. Boston: Little, Brown & Co., 1987.

Sager, Diane Proctor and Suzanne Kovarovic Bomar. Intravenous Medications: A Guide to Preparation, Administration and Nursing Management. Philadelphia: J.B. Lippincott Co., 1980, ch. 7.

INTRODUCTION:

Intravenous therapy subjects the patient to potential complications, many of which can be avoided if the nurse understands the risks involved and uses all available measures to prevent their occurrence. Local complications occur more frequently; systemic complications do occur, however, and are the most serious and at times are, indeed, life-threatening. The key is PREVENTION, NOT INTERVENTION!

LESSON PLAN: I
COURSE TITLE: INTRAVENOUS FLUID THERAPY
UNIT V RECOGNITION AND PREVENTION OF IV THERAPY
RELATED COMPLICATIONS

OUTLINE: (Key Points)

I. Terms and Definitions

- A. Air embolism - small bubbles accumulate and form tenacious bubbles that reach and obstruct the pulmonary capillaries
- B. Cellulitis - inflammation of cellular or connective tissue
- C. Circulatory overload - fluid accumulation in the lungs
- D. Hematoma - a localized mass of extravasated blood that is relatively or completely confined within an organ, tissue, or space
- E. Infection at site - bacterial invasion at venipuncture site resulting in an infectious disease process
- F. Infiltration - when parenteral fluids or a substance is invading surrounding tissue rather than infusing in the vein as intended
- G. Phlebitis - inflammation of a vein
- H. Pulmonary embolus - a free-floating substance, usually a blood clot, is propelled by the venous circulation to the right side of the heart and on into the pulmonary artery
- I. Pyrogenic reaction - febrile reaction occurring when pyrogens are introduced into the bloodstream; usually staph or strep
- J. Speed shock - a systemic toxic reaction occurring when a substance foreign to the body is rapidly introduced into the circulation
- K. Thrombophlebitis - inflammation of a vein associated with the formation of a thrombus
- L. Thrombus - blood clot

II. Local Complications

A. Hematoma

1. Signs and symptoms

- a. Discoloration adjacent to venipuncture site
- b. Swelling adjacent to venipuncture site

2. Nursing intervention

- a. Elevate extremity.
- b. Apply warm compresses (dependent on institutional policy, may need physician order).

3. Preventive measures

- a. Check patient's medical history for:
 - (1) Blood dyscrasia
 - (2) Anticoagulant therapy
 - (3) Chemotherapy
- b. Insert venipuncture cannula with bevel up and at a 25-30° angle.
- c. When discontinuing IV site, apply pressure at discontinued site with extremity elevated.
- d. When venipuncture attempt is unsuccessful, do not reapply tourniquet to same extremity without sufficient time lapse to prevent renewed bleeding.
- e. Do not apply tourniquet above an obvious hematoma site.
- f. Good patient teaching

B. Infiltration

1. Signs and symptoms

- a. Swelling of tissue adjacent to IV site
- b. Poor or no blood return at IV cannula
- c. Slowing of IV infusion with eventual cessation
- d. Skin adjacent to site is cool to touch
- e. Patient complaint of discomfort or pain

2. Nursing intervention
 - a. Discontinue immediately.
 - b. Elevate extremity.
 - c. Apply warm compresses (check institutional policy).
 - d. Notify physician if vesicant agent involved.
3. Preventive measures
 - a. Tension loop in IV administration set
 - b. Utilization of armboard if applicable
 - c. Proper application of restraints
 - d. Frequent monitoring of status of infusion
 - e. Employing safety precautions during patient transporting
 - f. Good patient teaching

C. Phlebitis

1. Types
 - a. Sterile - chemical - due to pH of drug or solution
 - b. Mechanical - due to irritating movement of cannula
 - c. Septic - due to contamination factors
2. Signs and symptoms
 - a. Tenderness
 - b. Redness
 - c. Warm to touch
 - d. Induration
 - e. Swelling
 - f. Possible temperature elevation
3. Nursing intervention
 - a. Discontinue site.
 - b. Elevate extremity.

- c. Apply warm compresses (check institutional policy).

4. Preventive measures

- a. Aseptic skin prep prior to cannula insertion
- b. Avoid multiple venipuncture attempts.
- c. Secure anchoring of cannula.
- d. Provide adequate hemodilution of cannula.
- e. Good daily maintenance of infusion/site
- f. Appropriate site selection for order
- g. Site rotation every 48-72 hours

D. Thrombophlebitis

1. Signs and symptoms - same as for phlebitis plus:

- a. Vein becomes hard and tortuous
- b. Extremely painful to touch
- c. Aching of entire extremity
- d. Slowing of infusion rate

2. Nursing intervention

- a. Discontinue site.
- b. Notify physician of observations.
- c. Provide therapeutic processes per physician orders.

3. Preventive measures - same as for phlebitis plus avoid lower extremities for venipuncture

SPECIAL PRECAUTION - thrombophlebitis is accompanied by the inherent danger of EMBOLUS.

E. Infection at site

1. Signs and symptoms

- a. Pain at site
- b. Redness
- c. Inflammation

- d. Swelling
- e. Temperature elevation (II-1)
- f. Purulent drainage

2. Nursing intervention

- a. Discontinue site and culture cannula tip and drainage; order for culture may be institutional policy
- b. Notify physician.
- c. Provide therapeutic process as ordered by physician.

3. Preventive measures

- a. Adherence to aseptic technique
- b. Good daily maintenance of infusion/site

F. Cellulitis

1. Signs and symptoms

- a. Redness
- b. Swelling
- c. Warm to touch
- d. Pain
- e. Induration
- f. May or may not be weeping

2. Nursing intervention

- a. Discontinue site.
- b. Notify physician.
- c. Provide therapeutic process as ordered by physician.

3. Preventive measures - same as for infection at site

G. Nerve damage

1. Signs and symptoms

- a. Tingling of extremity
- b. Numbness in fingers, hand, or arm

2. Nursing intervention
 - a. Remove armboard and/or restraints.
 - b. Relocate IV site to other extremity.
3. Preventive measures
 - a. Use well-padded armboards.
 - b. Proper application of restraints

III. Systemic Complications

A. Pyrogenic reaction (septicemia)

1. Occurs when pyrogens are introduced into the bloodstream, producing a febrile reaction; could be staph or strep organisms
2. Signs and symptoms
 - a. Chills
 - b. Fever
 - c. General malaise
 - d. Headache
 - e. Backache
 - f. Nausea and vomiting
 - g. Vascular collapse
 - h. Shock
3. Nursing intervention
 - a. Stop infusing solution, but aseptically reserve for potential future testing.
 - b. Reestablish IV at new site with new sterile solution, administration set, and cannula.
 - c. Monitor vital signs.
 - d. Notify physician.
 - e. Provide therapeutic processes as prescribed by physician.
4. Preventive measures
 - a. Aseptic technique

- b. Confirm sterility of equipment.
- c. 24-hour limit on infusing solution

B. Pulmonary embolus

1. Occurs when a substance, usually a blood clot, becomes free-floating and is propelled by the venous circulation to the right side of the heart and on into the pulmonary artery
2. Signs and symptoms
 - a. Sudden onset of chest pain
 - b. Tachycardia
 - c. Dyspnea
 - d. Cough productive of reddish-pink sputum
3. Nursing intervention (II-2)
 - a. Remain with patient.
 - b. Administer O₂.
 - c. Complete bed rest
 - d. Call physician.
 - e. Provide therapeutic processes as ordered by physician.
4. Preventive measures
 - a. Blood or plasma must be infused through an adequate filter to remove any particulate matter.
 - b. Avoid veins in lower extremities.
 - c. Positive pressure should not be used to relieve clot formation.
 - d. Dissolve reconstituted drugs completely and use filter when advisable.
 - e. Examine solutions for any particulate matter.

C. Air embolism (HO 1)

(II-3)

1. Small bubbles accumulate and form tenacious bubbles that block the pulmonary capillaries
2. Signs and symptoms

- a. Sudden onset of pallor
- b. Cyanosis
- c. Dyspnea
- d. Cough
- e. Weak, rapid pulse
- f. Drop in blood pressure
- g. Syncope
- h. Shock
- i. Loss of consciousness

3. Nursing intervention

- a. Stop source of air.
- b. Place patient on left side in Trendelenburg's position. (HO 2)
- c. Administer O₂.
- d. Notify physician immediately.
- e. Provide therapeutic processes as prescribed by physician.

SPECIAL PRECAUTION: Unless treatment is instituted immediately, death can rapidly ensue.

4. Preventive measures

- a. Luer-lok connections
- b. Reinforcement of connections with tape
- c. Avoid bypassing electronic infusion pump housing for IV piggyback infusions.
- d. Proper gown changing
- e. Use shoulder-snap gowns for central venous line patients.
- f. Have patient perform Valsalva's maneuver during central line insertion and tubing changes.
- g. Monitor IV closely to prevent "run-dry."

D. Circulatory overload

- I. Signs and symptoms

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- a. Venous distention - engorged neck vein
- b. Increased blood pressure
- c. Rise in venous pressure
- d. Rapid respirations with dyspnea
- e. Cough
- f. Wide variance between fluid intake and output

2. Nursing intervention

- a. Remain with patient.
- b. Slow infusion to KVO rate.
- c. Place patient in sitting position to facilitate breathing.
- d. Monitor vital signs carefully.
- e. Call physician.
- f. Provide therapeutic processes as prescribed by physician.

3. Preventive measures

- a. Infusions should be maintained at flow rate ordered and should be appropriate for patient's clinical condition.
- b. Positive pressure should never be applied by nurse to infuse solution.
- c. Never play "catch-up" when fluids are behind schedule.
- d. Make sure physician is aware of 24-hour IV piggyback fluid volume.

E. Speed shock

1. Signs and symptoms

- a. Flushed face and headache
- b. Syncope
- c. Shock
- d. Cardiac arrest

2. Nursing intervention

- a. Slow IV to KVO rate.

- b. Notify physician.
 - c. Provide therapeutic processes as prescribed by physician.
 - d. Resuscitate if necessary.
- 3. Preventive measures
 - a. Administer drugs at manufacturer's recommended rate.
 - b. Administer fluids at prescribed rate.
 - c. Keep flow control clamp out of reach of disoriented, confused patients and/or pediatric patients.
 - d. Monitor flow rate at least once per hour.

F. Catheter emboli

- 1. Types
 - a. Immediate discovery - discovered at time of occurrence
 - b. Delayed discovery - discovered at time site was discontinued
- 2. Signs and symptoms - obvious fragmentation of cannula
- 3. Nursing intervention
 - a. If immediate discovery
 - (1) Remain with patient.
 - (2) Apply tourniquet to involved extremity at torso junction.
 - (3) Notify physician immediately.
 - (4) Provide therapeutic processes as prescribed by physician.
 - (5) Save portion of catheter removed.
 - b. If delayed discovery
 - (1) Notify physician immediately.
 - (2) Provide therapeutic processes as prescribed by physician.
 - (3) Always save portion of catheter originally removed.
- 4. Preventive measures
 - a. Proper cannula insertion technique

- b. Do not use scissors to cut away site dressing.
- c. Confirm cannula integrity prior to insertion.

IV. Summary and Conclusion

- A. Terms and definitions
- B. Local complications
- C. Systemic complications

LESSON PLAN: 1
COURSE TITLE: INTRAVENOUS FLUID THERAPY
UNIT V RECOGNITION AND PREVENTION OF IV THERAPY
RELATED COMPLICATIONS

INTERACTION ITEMS:

1. How would you determine the significance of an elevated temperature of a patient with IV therapy?
2. What is the importance of patient reassurance?
3. How can air embolism be prevented from occurring?

CLASSROOM, LABORATORY, OR OTHER ACTIVITIES:

1. Role-play nursing intervention with displayed signs and symptoms of IV complications.

LESSON PLAN: 1
COURSE TITLE: INTRAVENOUS FLUID THERAPY
UNIT V RECOGNITION AND PREVENTION OF IV THERAPY
RELATED COMPLICATIONS

EVALUATION ITEMS:

Match the following terms to correct definitions:

- ___ 1. Hematoma
 - ___ 2. Cellulitis
 - ___ 3. Speed shock
 - ___ 4. Air embolism
 - ___ 5. Infiltration
 - ___ 6. Infection at site
 - ___ 7. Pyrogenic reaction
 - ___ 8. Circulatory overload
 - ___ 9. Phlebitis
 - ___ 10. Thrombus
 - ___ 11. Pulmonary embolus
 - ___ 12. Thrombophlebitis
- a. Small bubbles accumulate and form tenacious bubbles that reach and obstruct the pulmonary capillaries
 - b. Fluid accumulation in the lungs
 - c. A free-floating substance, usually a blood clot, is propelled by the venous circulation to the right side of the heart and on into the pulmonary artery
 - d. Febrile reaction occurring when a substance is introduced into the bloodstream--usually staph or strep
 - e. A systemic toxic reaction that occurs when a substance foreign to the body is rapidly introduced into the circulation

- f. Inflammation of cellular or connective tissue
- g. Bacterial invasion at venipuncture site resulting in an infectious disease process
- h. A localized mass of extravasated blood that is relatively or completely confined within an organ, tissue, or space
- i. Blood clot
- j. Inflammation of a vein associated with the formation of a thrombus
- k. Inflammation of a vein
- l. When parenteral fluids or a substance is invading surrounding tissue rather than infusing in the vein as intended

Match the following symptoms to the complications:

- ___ 13. Pyrogenic reaction (septicemia)
- ___ 14. Pulmonary embolus
- ___ 15. Air embolism
- ___ 16. Circulatory overload
- ___ 17. Speed shock
- ___ 18. Hematoma
- ___ 19. Infiltration
- ___ 20. Phlebitis
- ___ 21. Thrombophlebitis
- ___ 22. Infection at site
- ___ 23. Cellulitis
- ___ 24. Nerve damage
- ___ 25. Catheter emboli
- a. Discoloration and/or swelling adjacent to venipuncture site
- b. Tenderness, redness, warm to touch, induration, swelling, possible temperature elevation
- c. Chills, fever, general malaise, headache, backache, nausea and vomiting, vascular collapse, shock
- d. Sudden onset of pallor, cyanosis, dyspnea, cough, weak/rapid pulse, drop in blood pressure, syncope, loss of consciousness

- e. Swelling of tissue adjacent to IV site, poor or no blood return at IV cannula, slowing of IV infusion with eventual cessation, skin adjacent to site cool to touch, complaint of discomfort or pain
- f. Tingling of extremity, numbness in fingers, hand, or arm
- g. Sudden onset of chest pain, tachycardia, dyspnea, cough productive of reddish-pink sputum
- h. Flushed face and headache, syncope, shock, cardiac arrest
- i. Obvious fragmentation of cannula
- j. Possible temperature elevation, swelling, induration, warm, red, vein becomes hard and tortuous, extremely painful to touch, aching of entire extremity
- k. Venous distention - engorged neck vein, increased blood pressure, rise in venous pressure, rapid respirations with dyspnea, cough
- l. Pain at site, redness, inflammation, swelling, temperature elevation, purulent drainage
- m. Redness, swelling, warm to touch, pain, induration, may or may not be weeping

Match the following complications to the correct nursing interventions.

- ___ 26. Catheter emboli
- ___ 27. Speed shock
- ___ 28. Thrombophlebitis
- ___ 29. Air embolism
- ___ 30. Phlebitis
- ___ 31. Circulatory overload
- ___ 32. Pulmonary embolus
- ___ 33. Infection at site
- ___ 34. Pyrogenic reaction (septicemia)
- ___ 35. Nerve damage
- ___ 36. Infiltration
- ___ 37. Hematoma
- a. Remain with patient, administer O₂, complete bed rest, call physician, provide therapeutic processes as ordered by physician

- b. Discontinue IV immediately, elevate extremity, apply warm compresses, notify physician if vesicant agent is involved
- c. Stop infusing solution, but aseptically reserve for potential future testing, KVO with new solution and administration set, monitor vital signs, notify physician, provide therapeutic processes as prescribed by physician
- d. Remain with patient, slow infusion to KVO, place patient in sitting position to facilitate breathing, monitor vital signs carefully, call physician, provide therapeutic processes as prescribed by physician
- e. Discontinue site, elevate extremity, warm compresses per institutional policy
- f. Stop source of air, place patient on left side in Trendelenburg's position, administer O₂, notify physician immediately, provide therapeutic processes as prescribed by physician
- g. Discontinue site and culture cannula, notify physician, provide therapeutic processes as ordered by physician
- h. Discontinue site, notify physician of observations, provide therapeutic process per physician's order
- i. Elevate extremity, apply warm compresses per institutional policy
- j. Remove arm board and/or restraints, relocate IV site to other extremity
- k. Immediate discovery: remain with patient, apply tourniquet to involved extremity at torso junction, notify physician immediately, provide therapeutic processes as prescribed by physician; Delayed discovery: notify physician immediately, provide therapeutic process as prescribed by physician
- l. Slow IV to KVO rate, monitor flow rate at least once per hour, notify physician, provide therapeutic processes as prescribed by physician, resuscitate if necessary

LESSON PLAN: I

COURSE TITLE: INTRAVENOUS FLUID THERAPY

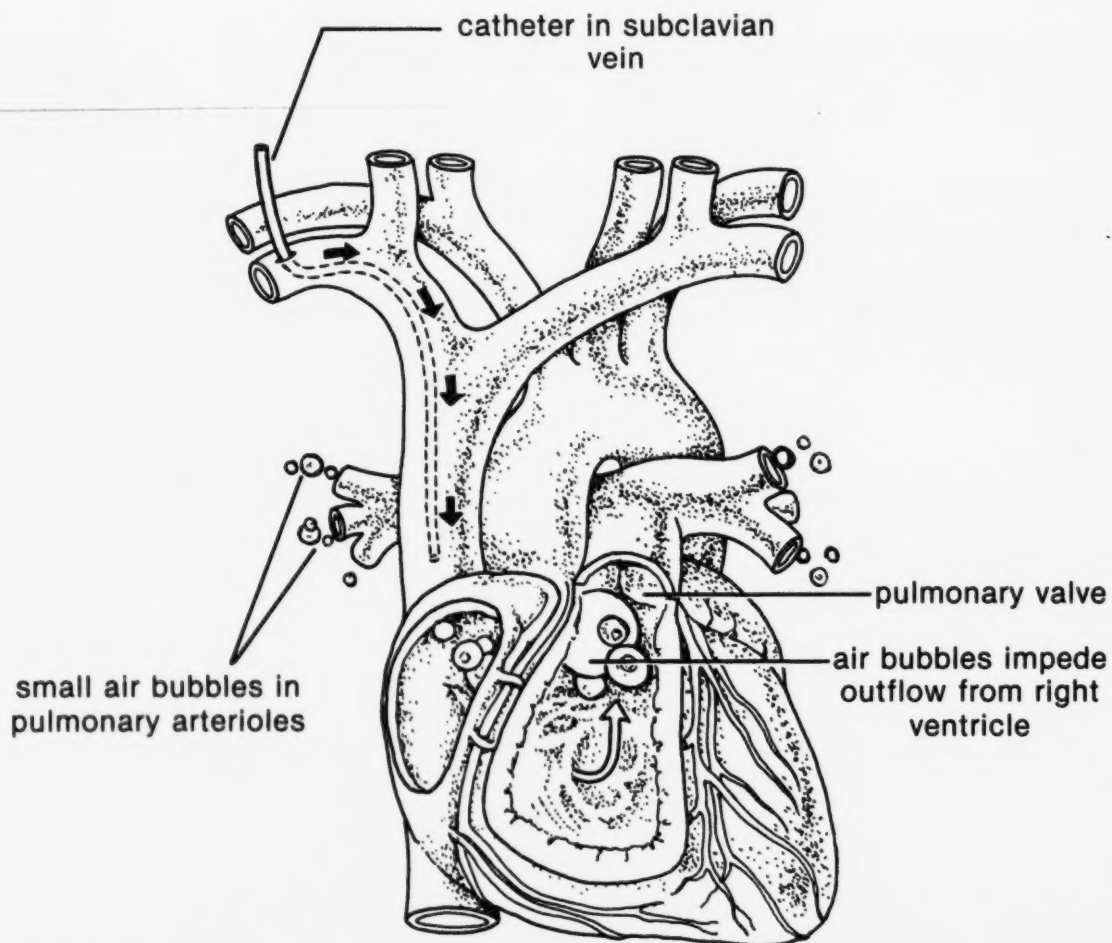
UNIT V RECOGNITION AND PREVENTION OF IV THERAPY

RELATED COMPLICATIONS

ANSWERS TO EVALUATION ITEMS:

1. h
2. f
3. e
4. a
5. l
6. g
7. d
8. b
9. k
10. i
11. c
12. j
13. c
14. g
15. d
16. k
17. h
18. a
19. e
20. b
21. j
22. l
23. m
24. f
25. i
26. k
27. l
28. h
29. f
30. e
31. d
32. a
33. g
34. c
35. j
36. b
37. i

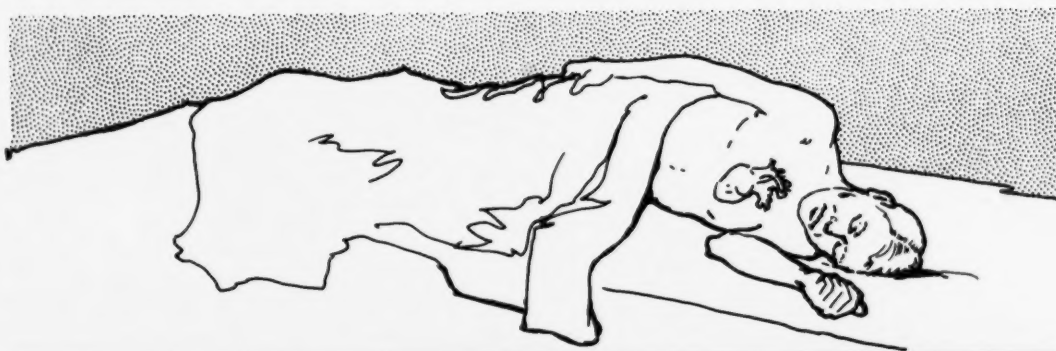
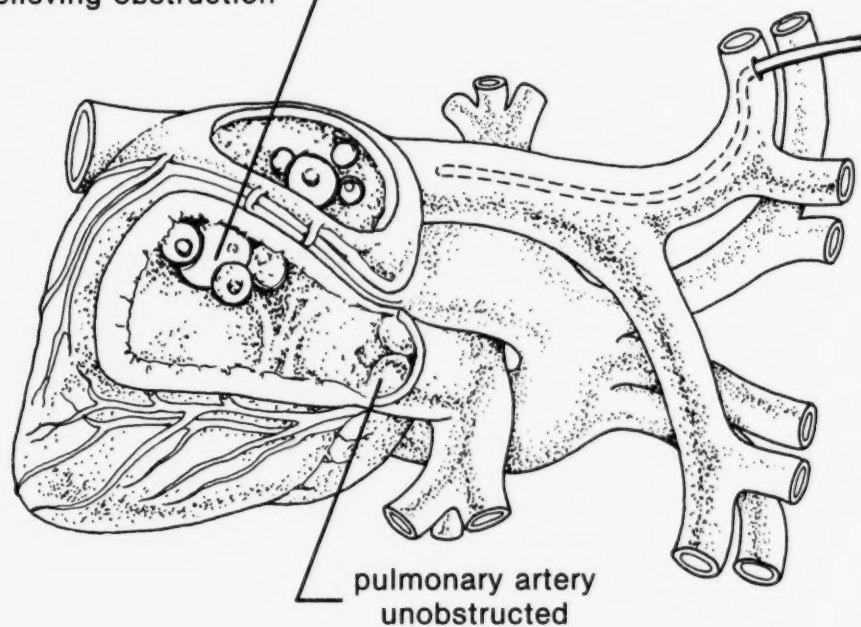
Air Embolism



In venous air embolism, air enters the right ventricle through a systemic vein and impedes the outflow of blood.

Positioning the Patient with Air Embolism

air bubbles rise,
relieving obstruction



Placing the patient in the left lateral and Trendelenburg's position relieves the obstruction of blood flow through the pulmonary artery.

LESSON PLAN: 2
COURSE TITLE: INTRAVENOUS FLUID THERAPY
UNIT V RECOGNITION AND PREVENTION OF IV THERAPY
RELATED COMPLICATIONS

SCOPE OF UNIT:

This unit will present the signs and symptoms of both systemic and local IV therapy complications. It will include preventive measures and nursing interventions should such complications occur.

INFORMATION TOPIC: X OR DEMONSTRATION:

INFECTION CONTROL
(Lesson Title)

LESSON OBJECTIVES - THE STUDENT WILL BE ABLE TO:

1. Name three intrinsic factors which are potential mechanisms for contamination of the intravenous infusion system.
2. Name three extrinsic factors which are potential mechanisms for contamination of the intravenous infusion system.
3. Identify preventive measures for infection control.
4. Identify CDC guidelines for prevention of IV therapy related infections.
5. Identify CDC guidelines for preventing transmission of the AIDS virus.

SUPPLEMENTARY TEACHING/LEARNING ITEMS:

1. HO 1: CDC Guidelines for Prevention of Intravenous Therapy-Related Infections
2. HO 2: CDC Guidelines for Preventing Transmission of the AIDS Virus

INFORMATIONAL ASSIGNMENT:

Plumer, Ada Lawrence. Principles and Practice of Intravenous Therapy. 4th ed. Boston: Little, Brown and Co., 1987.

REFERENCES:

Palmer, Monica. Infection Control - A Policy and Procedure Manual. Philadelphia: W.B. Saunders Co., 1984, pp. 103-118.

Plumer, Ada Lawrence. Principles and Practice of Intravenous Therapy. 4th ed. Boston: Little, Brown and Co., 1987.

U.S. Department of Health and Human Services. Intravascular Infections: Intravenous Therapy Related. Atlanta: Centers for Disease Control, 1982.

U.S. Department of Health and Human Services. Guideline for Handwashing and Hospital Environmental Control, 1985. Atlanta: Centers for Disease Control. Reprinted by Missouri Department of Health, pp. 99-1117.

INTRODUCTION:

Any patient who enters the hospital and requires certain procedures may be susceptible to acquiring a nosocomial infection. With the understanding that these bacterial infections can be aerobic or anaerobic, require food, and prefer body temperature, we can begin prevention. When these procedures are performed with the utmost care and with infection control in mind, the risk of infection is minimized. Intravenous therapy offers a ready means of direct access to the patient's vascular system for microorganisms which would generally succumb to normal skin defense mechanisms. In our lesson today, we will look at the causes of nosocomial infection and safety measures taken by health care personnel to assure asepsis.

LESSON PLAN: 2
COURSE TITLE: INTRAVENOUS FLUID THERAPY
UNIT V RECOGNITION AND PREVENTION OF IV THERAPY
RELATED COMPLICATIONS

OUTLINE: (Key Points)

- I. Potential Sources for Contamination of Intravenous Infusion System (II-I)
 - A. Intrinsic - present prior to use
 1. Cracks in glass bottles
 2. Punctures in plastic containers
 3. Infusion fluid or additives
 4. Closure system - bottle
 5. Tubing
 6. Ointments
 7. Cannula
 - B. Extrinsic - introduced in use
 1. Additives
 2. Container changes
 3. Attachment of apparatus
 4. Contaminated air
 5. Injections
 6. CVP lines
 7. Filters
 8. Insertion and manipulation of cannula

II. Preventive Infection Control Measures

A. Handwashing (II-2)

1. Hands are commonly contaminated with patient's gram-negative organisms, many of which are resistant to multiple antibiotics.
2. Wash hands prior to cannula insertion, tubing and bottle changes or handling any IV equipment.
3. Iodophor solutions for handwashing are slow-acting and require at least two minutes of washing to be effective against microorganisms.

B. Inspection of equipment

1. Visually inspect all containers against a light and dark background for cracks, leaks, and evidence of particulate matter.
2. Check for package integrity of administration equipment.

C. Site Preparation

1. Do not shave skin (clip hair if necessary). Shaving may result in abrasions that provide bacteria with direct entry route.
2. Skin prep over one minute with bacteriocidal as approved by institutional protocol
3. Use circular cleansing motion—center to outside.

D. Observe blood contamination guidelines (HO 2)

1. Wear protective gloves when performing procedures associated with blood contact (II-3)
2. Wear gown mask and protective eye shield if blood splattering could occur
3. Do not recap needles on IV catheter stylets (II-4)
4. Place used needles and IV catheter stylets in a punctureproof container. Do not cut or bend needles or stylets.

E. Cannula insertion with optimal aseptic technique

1. Avoid touch contamination of prepped site.
2. Cannula is for one time only insertion.
3. May apply an antimicrobial agent to insertion site if approved by institutional policy.

4. Secure cannula with tape to prevent to and fro motion and to avoid transport of cutaneous bacteria into wound.

CAUTION: Avoid nonsterile tape over insertion site.

5. Apply sterile dressing over insertion site.
6. Avoid bulky dressings which prevent examination of site for infiltration or phlebitis.
7. Label dressing with date; time; type, gauge, and length of cannula; your initials
8. A documentation of insertion procedure must be in the medical record to ensure site rotations are appropriately performed.

F. Maintenance measures

1. Evaluate IV site at least one time every hour.
 - a. Gentle palpation
 - b. Visual inspection
2. Change peripheral cannula every 48-72 hours.
3. Aseptically change dressings according to CDC recommendations. (HO 1)
 - a. Peripheral - every 48 hours
 - b. Central venous line
 - (1) Transparent - every 72 hours
 - (2) Gauze - every 24 hours
 - c. PRN if wet, soiled, or nonocclusive
 - d. Antimicrobial agent, if used, should be reapplied with each dressing change.
4. Aseptically change administration set tubing, including piggyback tubing, according to CDC recommendations.
 - a. Peripheral - every 48 hours
 - b. Central venous - every 24 hours
 - c. Fat emulsion - with each container completion

d. PRN

(1) When suspected or apparent contamination or defect of set

(2) Existence of residual blood in set

e. Routine changing of IV administration sets should coincide with the time a new container of solution is initiated.

f. Tubing junctions should be secured by an appropriate method such as a Luer-Lok[™], junction clamping device, or tape.

5. When multi-use containers intended for IV use are opened, they should be marked with the date and time the container is entered. Discard according to institutional policy.

III. Summary and Conclusion

A. Potential sources for contamination of intravenous infusion system

B. Preventive infection control measures

LESSON PLAN: 2

COURSE TITLE: INTRAVENOUS FLUID THERAPY

UNIT V RECOGNITION AND PREVENTION OF IV THERAPY

RELATED COMPLICATIONS

INTERACTION ITEMS:

1. What are possible contaminants in IV therapy?
2. Is it really necessary to use a special handwashing technique before handling IV equipment, site, or dressing?
3. When is it necessary to wear gloves when performing IV therapy procedures?
4. Should you recap needles and/or IV catheter stylets?

CLASSROOM, LABORATORY, OR OTHER ACTIVITIES:

1. Have students wash hands carefully, then obtain cultures for culture plates.

LESSON PLAN: 2
COURSE TITLE: INTRAVENOUS FLUID THERAPY
UNIT V RECOGNITION AND PREVENTION OF IV THERAPY
RELATED COMPLICATIONS

EVALUATION ITEMS:

1. Three intrinsic factors which are potential mechanisms for contamination of the intravenous infusion system are:
 - a.
 - b.
 - c.
 - d.
2. Three extrinsic factors which are potential mechanisms for contamination of the intravenous infusion system are:
 - a.
 - b.
 - c.
 - d.

Multiple Choice: For each of the following, circle the letter of the correct answer.

3. Preventive handwashing includes:
 - a. Using a therapeutic skin cleanser (octoxynol 3) over one minute scrub.
 - b. Knowing hands are contaminated with gram-negative organisms easily destroyed by water.
 - c. Scrubbing with iodophor solution over two minutes.
 - d. Always wearing sterile gloves.
4. To prepare the IV site:
 - a. Omit prep if patient is allergic to iodophor solution.
 - b. If patient has much hair at site, it should be carefully shaved as hair harbors bacteria.
 - c. Always wear gloves.
 - d. None of the above

5. CDC guidelines regarding blood contaminations recommend:
 - a. Wear protective gloves when performing procedures associated with blood contact.
 - b. Do not recap needles or IV catheter stylets.
 - c. Wear gown, mask and protective eye shade if blood spattering could occur.
 - d. a and c
 - e. All of the above
6. When inserting the IV cannula:
 - a. Always use a microbial agent at the site.
 - b. Avoid touch contamination of the prepped site.
 - c. Secure immediately with sterile tape to prevent cannula motion trauma.
 - d. a and c
 - e. All of the above
7. To maintain the IV site:
 - a. Evaluate the site at least one time every eight hours.
 - b. Change peripheral cannula every 24 hours.
 - c. Adhere to CDC guidelines regarding needle, tubing and dressing changes.
 - d. All the above
 - e. None of the above

LESSON PLAN: 2
COURSE TITLE: INTRAVENOUS FLUID THERAPY
UNIT V RECOGNITION AND PREVENTION OF IV THERAPY
RELATED COMPLICATIONS

ANSWERS TO EVALUATION ITEMS:

1. The student may list any three of the following:

- a. Cracks in glass bottles
- b. Punctures in plastic containers
- c. Infusion fluid or additives
- d. Closure system - bottle
- e. Tubing
- f. Ointments
- g. Cannula

2. The student may list any three of the following:

- a. Additives
- b. Container changes
- c. Attachment of apparatus
- d. Contaminated air
- e. Injections, irrigation
- f. CVP lines
- g. Filters
- h. Insertion and manipulation of cannula

- 3. c
- 4. d
- 5. e
- 6. d
- 7. c

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CDC Guidelines of Prevention of Intravenous Therapy-Related Infections

INTRODUCTION

Intravenous (IV) therapy is an integral part of modern patient care and is given to approximately 30% to 50% of hospitalized patients, especially those who are seriously ill. An IV system offers a ready means of direct access to a patient's vascular system for hemodynamic monitoring and for administering numerous agents that cannot be administered as effectively by other means. Unfortunately, IV systems also provide a potential route for microorganisms to enter the vascular system by bypassing normal skin defense mechanisms; these organisms can cause serious infection if they are allowed to enter and proliferate in the IV cannula (catheter) wound or IV fluid. IV therapy, therefore, is a potential cause of serious illness or death for hospitalized patients.

EPIDEMIOLOGY

IV-related infections consist of those related to microbial contamination of the cannula and the cannula wound (cannula-related) and those related to microbial contamination of the infusate (infusate-related). Most IV-related infections are cannula-related. Cannula-related infections are generally endemic, i.e., not part of an outbreak, while most recognized infusate-related infections are epidemic.

Cannula-related infections, which can occur with or without fever or bacteremia, include purulent thrombophlebitis, cellulitis, and "occult IV site infection." These infections are frequently preceded by or associated with phlebitis (usually characterized by warm, erythematous skin over an indurated or tender vein). Although phlebitis can be caused by infection, it is usually caused by mechanical or chemical irritation from the cannula or infusate. Purulent thrombophlebitis often has the same signs and symptoms as uncomplicated phlebitis but, in addition, is characterized by gross or microscopic evidence of suppuration within the lumen of the vessel; pus sometimes drains spontaneously from the cannula wound, but pressure may be required to express it. This infection is dangerous in that it frequently leads to high-grade bacteremia and often requires surgical removal of the vein for resolution. Cellulitis is characterized by warm, erythematous, and often tender and edematous skin surrounding the site of cannula insertion; pus is rarely detectable. "Occult IV-site infection" is a broadly defined term used to describe infections that characteristically do not produce much (if any) pus or inflammation at the IV site. Early in their course, these infections often have no systemic symptoms or signs. However, because they are the most common cannula-

related infections, they probably cause bacteremia more frequently than purulent thrombophlebitis or cellulitis do. Thus, occult IV-site infections pose an important and difficult diagnostic problem; diagnosis may depend on culturing of the cannula.

Factors that influence a patient's risk of acquiring a cannula-related infection include 1) patient susceptibility to infection; for example, certain burn and immunocompromised patients are more susceptible to these infections; 2) the type of cannula used; for example, plastic cannulas are generally associated with a higher rate of infection than steel ("scalp-vein") cannulas; 3) the method of insertion; for example, cannulas inserted by cutdown appear to be associated with a higher rate of infection than those inserted percutaneously; 4) duration of cannulation; for example, peripheral cannulas that have been in continuous use for longer than 48-72 hours are associated with a marked increased rate of infection; and 5) the purpose of the cannula; for example, central cannulas that are used for monitoring central venous pressure (CVP) are associated with comparatively high rates of infection. Because of differences among hospitals with regard to the factors that influence infection risk, reported rates of infection vary considerably. However, the frequency of 2 important complications has been estimated by combining data from a number of hospitals: Purulent thrombophlebitis occurs in about 0.2% and IV-related bacteremia in less than 1% of all patients who receive IV therapy (1).

Staphylococcus aureus, a gram-positive bacterium, is the single microorganism most frequently recovered from cannula-related infections, accounting for about 30% of the pathogens identified; but gram-negative bacteria (as a group) account for about 50% (1). The spectrum of pathogens does not appear to differ with the type of cannula used or hospital service, but the use of antibiotic and antiseptic ointments at the cannula site can change the flora encountered (e.g., from bacteria to fungi) and their antibiotic susceptibility patterns.

Determining whether bacteremia is related to the cannula is frequently difficult, since skin flora, especially *Staphylococcus epidermidis*, predominate when catheter tips are routinely cultured in broth, and the large majority of these organisms are not suspected of causing infection. Maki et al., however, described a semiquantitative method of culturing IV cannulas that appears to distinguish infection from contamination (2,3). High-density colonization of the cannula, as determined by this culture technique, correlates significantly with IV-related bacteremia and local inflammation.

Because frequent culturing is expensive and because most cannulas are not associated with infection, hospital personnel need to know when culturing an IV cannula is most likely to be helpful. In general, culturing should be useful whenever IV-related infection is suspected. Purulent thrombophlebitis or cellulitis at an IV site strongly suggests the presence of an IV-related infection, but culturing the cannula can confirm the diagnosis and isolate the causative organism; any gross pus should be gram-stained and cultured also. Culturing the cannula is also likely to be helpful whenever a patient receiving IV therapy develops fever or bacteremia and no focus of infection is apparent; culturing by the semiquantitative method can detect infection even when there is no visible evidence of infection at the IV site.

Infections related to microbial contamination of infusate occur much less frequently than cannula-related infections, but when they do occur, they are generally epidemic (4,5). Contamination can occur during manufacturing and before use (intrinsic contamination) or during hospital preparation or use (extrinsic contamination) when organisms are introduced during manipulation of the IV bottle, tubing, or devices connected to the tubing (piggyback infusions, stopcocks, etc.). Sepsis from the administration of contaminated infusates may be clinically indistinguishable from sepsis from other causes, but suspicion of this problem should be aroused when 1) signs and symptoms of sepsis appear immediately or shortly after infusion is initiated, especially when they occur in a patient in whom sepsis is unlikely and when there is no apparent focus of bacteremia; 2) antibiotic therapy with appropriate agents fails to resolve the sepsis as long as the infusion continues; 3) the patient rapidly improves when IV therapy is discontinued, with or without the use of antibiotics; or 4) the same organism is isolated from the patient's infusate and blood.

Infections caused by contaminated infusate are almost exclusively due to gram-negative bacilli, primarily members of the tribe Klebsiellae (*Klebsiella*, *Enterobacter*, and *Serratia* species), although *Citrobacter freundii* and *Pseudomonas thomasi* (cepacia) have also been implicated in epidemics. These organisms are able to proliferate in glucose-containing IV fluid; most other organisms either die or do not proliferate in such fluid (4,5). Isolation of one of these organisms from the bloodstream of a patient believed to have IV-related infection should suggest contaminated infusate rather than the more frequent cannula-related infection, although either may be responsible. When these organisms have been isolated in epidemics caused by intrinsically contaminated infusate, their antibiotic susceptibility patterns have often been distinct from nosocomial

bloodstream pathogens usually encountered in the institution, in that they have not demonstrated the usual multiple antibiotic-resistance patterns (5).

Hyperalimentation fluids, especially those containing crystalline amino acids, inhibit the growth of most microorganisms. However, *Candida* can proliferate in such fluids, albeit slowly (6). Lipid emulsions support rapid growth of a variety of microorganisms (7). Infection control recommendations for hyperalimentation will not be discussed in this guideline.

CONTROL MEASURES

Most control measures dealing with IV therapy are designed to encourage proper use of cannulas since cannula-related infections account for most IV-related infections. One of the first steps in initiating IV therapy is to decide what type of cannula should be used. Steel-needle cannulas have been associated with a lower risk of infection than plastic cannulas; however, the studies that have compared them have not been specifically randomized and controlled for type of cannula. Recently, a randomized, controlled study comparing steel and plastic cannulas showed no difference in the rates of infection related to the 2 types of cannula (8); however, this study excluded some patients at highest risk of infection, those in intensive care units, and was done in a hospital with an IV team that routinely changed cannulas at least every 72 hours. It appears reasonable to conclude from this study that plastic cannulas are safe for routine use in hospitals where all cannulas are changed every 48-72 hours (such as may be done by an IV team). In addition, because plastic cannulas tend to infiltrate or dislodge less frequently than steel cannulas, they are indicated whenever a secure access to the vascular system is needed and even temporary interruption of IV therapy might have serious sequelae. Further, plastic cannulas must be used for cannulation of central veins. Otherwise, stainless steel cannulas are probably safer for IV infusions.

The method and site of cannula insertion also appear to affect the rate of IV-related infections and complications. Insertion by percutaneous puncture rather than by cutdown is associated with a lower risk of infection (1). In adults, upper extremity, subclavian, and jugular sites of cannula insertion are associated with fewer complications, especially thrombophlebitis, than lower extremity sites.

Since most IV-related infections are postulated to result from inward progression of microorganisms contaminating the cannula wound, many control measures are aimed at preventing contamination of the insertion site. These include handwashing by personnel before cannula insertion, preparation of the IV site with an antiseptic, and application of an

antibiotic or antiseptic ointment at the skin-cannula junction at the time of insertion. Topical polyantibiotic ointments appear to reduce infections when used for insertions requiring a cutdown and may be efficacious for other insertions; antiseptic ointments (e.g., povidone iodine ointments) afford little, if any, benefit for most insertions (9, 10).

Other measures intended to prevent contamination of the insertion site include use of sterile dressings, acetone, subcutaneous tunneling, and methods of securing the cannula. Covering the IV site with a sterile dressing should reduce contact with contaminated hands and other objects. A recently developed transparent, semipermeable membrane dressing is being promoted for use on wounds, including IV cannula wounds; not enough information is available to evaluate the role of this dressing for cannula wounds. Cleaning the insertion site with acetone has been recommended to remove organic debris that may support bacterial growth, but this practice does not appear to prevent infection and appears to increase skin irritation (11). Inserting the cannula so that it enters the skin at a site away from where it enters the vein, i.e., subcutaneous tunneling, is a technique advocated for cannulas that are inserted into central veins and is intended (but this has not been proven) to block inward migration of microorganisms that contaminate the insertion site (12, 13). Securing the IV cannula after insertion may reduce motion that can injure the vein or, possibly, allow organisms to be pushed deeper into the cannula wound.

Regular maintenance and observation of the IV site is directed toward prevention or, at least, early detection of IV-related complications, such as phlebitis, or other signs that may indicate infection. Many experts recommend inspecting the IV site every 24 hours because this seems to be an adequate interval to detect early complications. Visual inspection of the insertion site is probably not necessary if 1) the site is palpated gently through the intact dressing, and no pain or tenderness is present, 2) the patient has no unexplained fever, and 3) peripheral cannulas are removed every 48-72 hours. Removing of peripheral cannulas after 48-72 hours is recommended because of the sharp increase in the rate of infection after this length of time. Recording the date and time of cannula insertion in the medical record or in another easily accessible location has been advocated to remind personnel of when to inspect the site or remove the cannula.

Control of infections related to contaminated infusate depends on 1) adequate manufacturing and quality control processes to ensure sterility, 2) aseptic compounding in hospitals, 3) prompt use of compounded parenterals, and 4) procedures to prevent in-use contamination. Other than reporting suspect-

ed intrinsic contamination of IV fluids to the U.S. Food and Drug Administration, individual hospitals generally cannot influence the first condition but can influence the last 3. Compounding of parenterals in the pharmacy rather than in patient-care areas might improve quality control and reduce exposure to hospital pathogens that can contaminate parenterals, especially if pharmacists are trained and experienced. Inspection of the IV container before compounding can detect leaks, cracks, or precipitants that suggest contamination, although it must be recognized that fluid contaminated with more than 10^5 bacteria per milliliter can appear normal and clear. Refrigeration will retard growth of microorganisms in IV fluid, and with hyperalimentation fluid, refrigeration at 4 °C has been shown to prevent growth for at least 7 days (6). However, the effect of refrigeration at temperatures higher than 4 °C, a condition that probably exists in many hospital refrigerators, has not been studied. At room temperature, organisms that grow in IV fluid, mainly those of the tribe Klebsiellae, can proliferate to large numbers in 24 hours; thus, experts usually recommend refrigeration of admixed IV fluids until use and discarding in-use IV fluids after 24 hours.

Administration sets and the fluid flowing through them can become contaminated during in-use manipulations, such as injecting medications and flushing lines, of the IV system. Special ports in the administration set are designed to reduce contamination by providing a means of adding medications without disconnecting a closed IV system. Once contaminated, sets can act as a nidus for microbial proliferation; therefore, routine changing is recommended. However, there is controversy about the proper interval for such changes. A 48-hour interval seems to result in no excess infection when compared with a 24-hour interval (14, 15). For administration sets used for hyperalimentation, a 24-hour changing interval is recommended by most authorities, although these sets appear no more prone to contamination than sets used for other types of infusions. In addition, some authorities recommend changing sets immediately after the administration of blood, blood products, or lipid emulsions because these agents greatly increase the spectrum of organisms that grow in IV fluid (16).

Some individuals and institutions have introduced additional measures to reduce IV-related infection. Many hospitals, recognizing that even the best IV-care protocols are not always followed by busy physicians and nurses, have instituted specially trained IV teams to insert IV cannulas and maintain IV cannulas and infusions. These teams, especially those used for hyperalimentation, appear promising in reducing IV-related infections; however, no con-

trolled trial has studied their effectiveness. IV filters have been added to the terminal end of administration sets in some institutions but have not been shown to reduce IV-related infection; they are, however, advocated by some for preventing a variety of noninfection complications of IV therapy.

RECOMMENDATIONS

1. Indications for Use

Intravenous (IV) therapy should be used only for definite therapeutic or diagnostic indications. *Category I*

2. Choice of Cannulas for Peripheral Infusions

- a. Plastic cannulas are acceptable for routine peripheral IV infusions if and only if the hospital can be sure that cannulas are replaced every 48-72 hours, such as can be done by an IV team. *Category II*
- b. Otherwise, stainless steel cannulas should be used for routine peripheral IV infusions, and plastic cannulas should be reserved for those clinical settings when a secure route for vascular access is imperative. *Category II*

3. Handwashing

- a. Hospital personnel should wash their hands before inserting an IV cannula. *Category I*
- b. Soap and water is adequate for handwashing for most insertions, but an antiseptic should be used before insertion of central cannulas and cannulas requiring a cutdown. *Category II*
- c. Sterile gloves should be worn for insertion of central cannulas and cannulas requiring a cutdown. *Category I*

4. Choice of Site

In adults, the upper extremity (or if necessary, subclavian and jugular sites) should be used in preference to lower extremity sites for IV cannulation. All cannulas inserted into a lower extremity should be changed as soon as a satisfactory site can be established elsewhere. *Category I*

5. Site Preparation

- a. The IV site should be scrubbed with an antiseptic prior to venipuncture. *Category I*
- b. Tincture of iodine (1%-2%) is preferred, but chlorhexidine, iodophors, or 70% alcohol can be used. The antiseptic should be applied liberally and allowed to remain in contact for at least 30 seconds prior to venipuncture. *Category II*
- c. Neither aqueous benzalkonium-like compounds nor hexachlorophene should be used to scrub the IV site. *Category I*

6. Procedures Accompanying Insertion

- a. A topical antibiotic or antiseptic ointment

should be applied at the IV site immediately after cannula insertion, especially for insertions by cutdown. *Category II*

- b. The cannula should be secured to stabilize it at the insertion site. *Category I*
- c. A sterile dressing should be applied to cover the insertion site. The dressing, and not tape, should cover the wound unless the tape is sterile. *Category I*
- d. The date of insertion should be recorded in a place where it can be easily found. *Category I* (The date may be recorded in the medical record and, if feasible, also on the dressing or tape.)

7. Maintenance of IV Site

- a. Patients with intravenous devices should be evaluated at least daily for evidence of cannula-related complications. This evaluation should include gentle palpation of the insertion site through the intact dressing. If the patient has an unexplained fever or there is pain or tenderness at the insertion site, the dressing should be removed and the IV site inspected. *Category I*
- b. For peripheral cannulas that must remain in place for prolonged periods, the IV site should be inspected and dressed with a new sterile dressing at 48-72 hours. Thereafter, the site should be inspected and dressed regularly (the optimal frequency of dressing cannula sites in this situation is not known). *Category II*
- c. Antibiotic or antiseptic ointment, if used, should be reapplied with each dressing change. *Category II*

8. Replacement of Peripheral Cannula

If prolonged IV therapy with a peripheral cannula (including heparin-lock devices and peripheral cannulas inserted by a cutdown) is indicated, the cannula should be changed and a new cannula inserted every 48-72 hours provided no IV-related complications requiring cannula removal are encountered before this. Cannulas inserted without proper asepsis, for example, those inserted in an emergency, should be replaced at the earliest opportunity. *Category I* (Peripheral cannulas may occasionally have to be used for longer than 48-72 hours if another peripheral site cannot be found.)

9. Special Procedures for Central Cannulas (those whose tips lie in the large central vessels)

- a. Central cannulas should be inserted with aseptic technique and sterile equipment. Gloves and drapes are usually required to achieve this objective. *Category I*

- b. All central cannulas should be removed when they are no longer medically indicated or if they are strongly suspected of causing sepsis. *Category I*
 - c. Central cannulas that are inserted through a subclavian or jugular approach, except those used for pressure-monitoring, need not be changed routinely. *Category I* (The proper frequency for changing cannulas that are used for pressure-monitoring, for example, those used to measure pulmonary artery or central venous pressure, is not known.)
 - d. Central cannulas that are inserted through a peripheral vein should be treated as peripheral cannulas (see appropriate recommendations above). *Category I*
 - e. For central cannulas that must remain in place for prolonged periods, the insertion site should be inspected and dressed with a new sterile dressing every 48-72 hours. *Category II*
- 10. Maintenance of Administration Sets**
- a. IV administration tubing, including "piggy-back" tubing, should be routinely changed every 48 hours. *Category I*
 - b. Tubing used for hyperalimentation should be routinely changed every 24-48 hours. *Category II*
 - c. Tubing should also be changed after the administration of blood, blood products, or lipid emulsions. *Category III*
 - d. Between changes of components, the IV system should be maintained as a closed system as much as possible. All entries into the tubing, as for administration of medications, should be made through injection ports that are disinfected just before entry. *Category I*
 - e. Flushing or irrigation of the system to improve flow should be avoided. *Category II*
 - f. Blood specimens should not be withdrawn through IV tubing except in an emergency or when immediate discontinuation of the cannula and tubing is planned. *Category II*
- 11. Changing Parts of the IV System for Infection or Phlebitis**
- a. The entire IV system (cannula, administration set, and fluid) should be changed immediately if purulent thrombophlebitis, cellulitis, or IV-related bacteremia is noted or strongly suspected. *Category I*
 - b. For phlebitis without signs of infection, the cannula should be changed. *Category I*
- 12. Culturing for Suspected IV-related Infections**
- a. If an IV system is to be discontinued because of suspected IV-related infection, such as purulent thrombophlebitis or bacteremia, the skin at the skin-cannula junction should be cleaned with alcohol and the alcohol allowed to dry before cannula removal, and the cannula should be cultured using a semi-quantitative technique (2,3). *Category II*
 - b. 1) If an IV system is discontinued because of suspected fluid contamination, the fluid should be cultured (5) and the implicated bottle saved. *Category I*
 - 2) If an IV system is discontinued because of suspected IV-related bacteremia, the fluid should be cultured. *Category III*
 - 3) If contamination of fluid is confirmed, the implicated bottle and the remaining units of the implicated lot should be saved, and the lot numbers of fluid and additives should be recorded. *Category I*
 - 4) If *intrinsic* contamination (contamination during manufacturing) is suspected, the local health authorities, CDC, and the U.S. Food and Drug Administration should be notified immediately. *Category I*
- 13. Quality Control During and After Admixture**
- a. Parenteral and hyperalimentation fluids should be admixed (compounded) in the pharmacy unless clinical urgency requires admixture in patient-care areas (see Guideline for Hospital Environmental Control: Pharmacy). *Category II*
 - b. Personnel should wash their hands before admixing parenterals. *Category I*
 - c. All containers of parenteral fluid should be checked for visible turbidity, leaks, cracks, and particulate matter and for the manufacturer's expiration date before admixing and before use. If a problem is found, the fluid should not be used and should be sent to (or remain in) the pharmacy. *Category I*
 - d. In the pharmacy, a laminar-flow hood should be used for admixing parenteral fluid. *Category II*
 - e. Single-use (single-dose) containers (vials) should be used for admixture whenever possible. When multiple-use containers intended for intravenous use are opened, they should be marked with the date and time that the container is entered. The product label or package insert should be consulted to determine if refrigeration of the container is necessary. *Category II*. (The proper storage temperature is product-specific and is determined by many factors such as stability of ingredients and optimal activity of antibacterial preservatives; bacteria survival in some con-

ainers may be enhanced by refrigeration (17). Unless an expiration date is stated on the product label or package insert, it is not known if multiple-use containers, once entered, should be discarded after a specific or arbitrary length of time.)

- f. A distinctive supplementary label should be attached to each admixed parenteral stating, as a minimum, the additives and their dosage, the date and time of compounding, the expiration time, and the person who did the compounding. *Category I*

- g. All admixed fluids should be refrigerated or started within 6 hours of admixing.

Category II

- h. If necessary, admixed parenterals may be stored in the refrigerator for up to a week before use provided refrigeration is continuous and begins immediately after admixing. Other factors, such as stability of ingredients, may dictate a shorter storage time.

Category II (This recommendation is intended to prevent waste of parenterals that are admixed for immediate use but, unexpectedly, cannot be used.)

- i. Once started, all parenterals should be completely used or discarded within 24 hours.

Category I

- j. Infusions of lipid emulsions should be completed within 12 hours of starting.

Category I

14. IV Filters

Using IV in-line filters is not recommended as a routine infection control measure.

Category II

15. IV Teams

Using professional, specially trained IV teams that insert and maintain IV cannulas may decrease the risk of IV-related infections.

Category III

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TAKEN FROM:

GUIDELINE FOR HANDWASHING AND HOSPITAL ENVIRONMENT CONTROL, 1985

Supersedes Guideline for Hospital Environmental Control
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Revised by Julia S. Garner, R.N., M.N. and Martin S. Favero, Ph.D
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CDC Guidelines for Preventing Transmission of the AIDS Virus

HO 2

The Centers for Disease Control (CDC) now recommends that health care providers take blood and body fluid precautions with all patients.

Universal precautions are especially important in emergency care settings, where the risk of exposure to blood is greater and the patient's infection status is usually unknown.

The CDC specifically recommends that all health care providers:

1. Wear gloves when touching blood and body fluids, mucous membranes, or broken skin of all patients. Gloves should also be worn when handling items or surfaces soiled with blood or body fluids and while performing **venipunctures** or other procedures that would involve vascular access. Change gloves after contact with each patient.
2. Prevent exposure to mucous membranes of the mouth, nose, and eyes when performing procedures that may cause spattering of blood or other body fluids. Wear masks, protective eye wear or face shields, and gowns or aprons as necessary.
3. Wash hands and other skin surfaces immediately and thoroughly if they become contaminated with blood or other body fluids. Hands should also be washed immediately after removing gloves.
4. Care should be taken to prevent injuries from needles, scalpels, and other sharp instruments. Special care should be employed when performing procedures, cleaning used instruments, disposing of used needles, and handling sharp instruments after procedures. To prevent needlestick injuries, **DO NOT RECAP**, bend or break needles; **DO NOT** remove them from disposable syringes or otherwise manipulate them by hand.
5. Place used disposable syringes and needles, scalpel blades, and other sharp items in puncture-resistant containers for disposal. (These containers should be placed as close as practical to the area where they would be needed. Place large-bore reusable needles in a puncture-resistant container for transport to the appropriate reprocessing area.

Special Circumstances;

The CDC also recommends that health care providers who have exudative lesions or weeping dermatitis **not perform** any direct patient care or handle patient care equipment until the condition clears.

Invasive Procedures:

According to the CDC, health care providers should take the following precautions with invasive procedures:

1. Routinely use appropriate barrier precautions to prevent skin and mucous membrane contact with blood or body fluids of all patients. Wear gloves and surgical masks for **all invasive procedures**. Use protective eye wear or face shields and gowns or aprons for procedures that commonly cause droplets, splashes of blood or body fluids, or bone chips.
2. If a glove is torn or punctured, it should be removed and a new glove put on.

Excepted and adapted from "Recommendations for Prevention of Human Immunodeficiency Virus (HIV) Transmission in Health-Care Settings" Centers for Disease Control, Morbidity and Mortality Weekly Report, August 21, 1987.

The U.S. Department of Labor Mandates AIDS Protection:

Compliance with the CDC Guidelines by health care institutions are **mandatory** and are being enforced by the department's Occupational Safety and Health Administration (OSHA). Institutions failing to comply with the mandatory guidelines could be fined up to \$10,000. Effective October, 1987.

LESSON PLAN: I
COURSE TITLE: INTRAVENOUS FLUID THERAPY
UNIT VI ADMINISTRATION OF INTRAVENOUS FLUID THERAPY

SCOPE OF UNIT:

This unit discusses means to facilitate the process of intravenous fluid therapy administration for all patients, including the pediatric and geriatric patient. Recognition of specific psychological needs of the patient as well as intervention techniques are discussed, as are aspects of patient preparation. Safe and knowledgeable application of skills and techniques in identification of IV equipment, preadministration preparation, and the actual initiation techniques of IV therapy are also included.

INFORMATION TOPIC: X OR DEMONSTRATION:

PATIENT APPROACH
(Lesson Title)

LESSON OBJECTIVES - THE STUDENT WILL BE ABLE TO:

1. State the rationale for preparing the patient for intravenous therapy.
2. Name four areas that should be covered in the teaching plan.
3. List three factors which influence a patient's degree of anxiety in receiving IV therapy.
4. List five of the patient's personal psychosocial resources.
5. Summarize effects of stress on the patient involving the following:
 - a. Nervous system
 - b. Cardiovascular system
 - c. Emotional
6. List four nursing approaches for emotional support of an IV therapy patient.
7. Name two factors which may cause lack of cooperation on the part of the patient during IV therapy.
8. List three nursing approaches which may be used for IV fluid administration with an uncooperative patient.

SUPPLEMENTARY TEACHING/LEARNING ITEMS:

- I. Trainex #987: "IV Therapy: Preparing Patient, Selecting Intravascular Cannula, Selecting Infusion Site

INFORMATIONAL ASSIGNMENT:

Plumer, Ada Lawrence. Principles and Practice of Intravenous Therapy. 4th ed. Boston: Little, Brown & Co., 1987.

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INTRODUCTION:

While the technical details of intravenous drug therapy are attended to, the special psychological needs of the patient are often minimized or disregarded. An intravenous line may represent little more than an annoyance or uncomfortable procedure. Yet, some patients may have fears and anxieties which must be considered as an integral part of the patient's care, worthy of consideration in the nursing care plan with approaches for solutions within the teaching plan.

LESSON PLAN: I

COURSE TITLE: INTRAVENOUS FLUID THERAPY

UNIT VI ADMINISTRATION OF INTRAVENOUS FLUID THERAPY

OUTLINE: (Key Points)

I. Patient Preparation - Psychological

A. Rationale of Preparation

1. Goal

- a. IV fluid therapy that minimizes the potential for IV complications (II-1)
- b. IV fluid therapy that minimizes discomfort

2. Results of preparation

- a. Patient cooperation
- b. Participation in care
- c. Acceptance and alleviation of fears

B. Process of patient preparation - activity

1. Assessment (II-2)

- a. Stage of illness
- b. Need for therapy

2. Planning (II-3)

a. Teaching

- (1) Purpose of therapy
- (2) Method of administration
- (3) Possible duration of therapy
- (4) Limitations - restrictions
 - (a) Mobility
 - (b) Maintain dryness of site

b. Feedback

II. Factors Influencing Patient Anxiety

- A. Conception that IV therapy is reserved for the seriously/critically ill
- B. Fear of the unknown (escalated when needle is involved)
- C. Previous traumatic IV therapy experience
- D. Lack of or inappropriate patient preparation for procedure
- E. Nature of underlying illness
- F. Significance of the IV fluid therapy and relationship to illness
- G. Patient's personal psychological resources (II-4)
 - 1. Age
 - 2. Individual's premorbid personality
 - 3. Family relationships
 - 4. Presence of other concerns
 - 5. Previous experience with illness and pain
 - 6. Relationship with members of health care team

III. Effects of Stress on the Patient (II-5)

- A. Physical
 - 1. Autonomic nervous system (vasovagal reaction)
 - a. Vasodilation
 - b. Drop in arterial blood pressure
 - c. Syncope
 - d. Diaphoresis
 - 2. Cardiovascular system (pulmonary edema) - marked fluid retention and vascular overload
- B. Emotional
 - 1. Dependent, regressive behavior
 - 2. Aggressive behavior

- IV. Approaches for Emotional Support for the IV Therapy Patient
 - A. Establish and maintain good interpersonal rapport with patient/patient's family.
 - B. Provide appropriate patient teaching.
 - C. Obtain order for stress-reducing medication when indicated.
 - D. Exhibit expertise in IV therapy procedures.
 - E. Reassurance of close monitoring
- V. The Uncooperative Patient
 - A. Exhibits uncooperativeness by:
 - 1. Verbal abusiveness
 - 2. Physical assault of care providers
 - 3. Removing cannula
 - 4. Altering flow rate
 - 5. Disrupting delivery
 - B. Factors in noncooperation
 - 1. Patient's reaction to stress
 - 2. Alteration in mental status
 - a. Mentally handicapped
 - b. Atherosclerotic cerebrovascular disease
 - c. Chronic brain syndrome
 - d. Drug induced
 - e. Other underlying disease
 - 3. Hearing impairment
 - 4. Language barriers
 - C. Provide diversional activities for the uncooperative patient
 - 1. Close monitoring of patient
 - 2. Use discrimination in selection of IV site.
 - 3. Assess possible alternative routes of medical administration.

4. Behavior modifying medications
5. Use of restraints or safety mittens when indicated
(Use is dependent on institutional policy.)

VI. Summary and Conclusion

- A. Patient preparation - psychological
- B. Factors influencing patient anxiety
- C. Effects of stress on the patient
- D. Approaches for emotional support for the IV therapy patient
- E. The uncooperative patient

LESSON PLAN: I

COURSE TITLE: INTRAVENOUS FLUID THERAPY

UNIT VI ADMINISTRATION OF INTRAVENOUS FLUID THERAPY

INTERACTION ITEMS:

1. Why is it a necessity to psychologically prepare a patient for IV fluid therapy?
2. Why is it necessary to assess a patient for stage of illness or need of therapy?
3. How would planning assist in helping a patient to understand therapy and the need for such treatment, gain cooperation, and participate in care?
4. How can a patient's personal psychological resources influence present IV fluid therapy administration?
5. Why would a nurse need to know the effects of stress on the patient?

CLASSROOM, LABORATORY, OR OTHER ACTIVITIES:

1. Role-play patient situations that demonstrate nursing approaches, interventions, planning

LESSON PLAN: 1

COURSE TITLE: INTRAVENOUS FLUID THERAPY

UNIT VI ADMINISTRATION OF INTRAVENOUS FLUID THERAPY

EVALUATION ITEMS:

1. State the rationale for preparing the patient for intravenous therapy.
2. Name four areas that should be covered in the teaching plan.
 - a.
 - b.
 - c.
 - d.
3. List three factors which influence a patient's degree of anxiety in receiving IV drug therapy.
 - a.
 - b.
 - c.
4. List five of the patient's personal psychological resources.
 - a.
 - b.
 - c.
 - d.
 - e.
5. Discuss effects of stress on the patient, involving the:
 - a. Autonomic nervous system -

- b. Cardiovascular system -
 - c. Emotional -
-
- 6. List four nursing approaches for emotional support of an IV therapy patient.
 - a.
 - b.
 - c.
 - d.
 - 7. Name two factors which may cause noncooperation.
 - a.
 - b.
 - 8. List three nursing approaches for IV fluid administration with an uncooperative patient.
 - a.
 - b.
 - c.

LESSON PLAN: I
COURSE TITLE: INTRAVENOUS FLUID THERAPY
UNIT VI ADMINISTRATION OF INTRAVENOUS FLUID THERAPY

ANSWERS TO EVALUATION ITEMS:

1. The goal of patient preparation is to facilitate IV fluid therapy that minimizes potential complications and discomfort, with the desired results of patient cooperation, patient participation in care, patient acceptance, and alleviation of fears.
2.
 - a. Purpose of therapy
 - b. Method of administration
 - c. Possible duration of therapy
 - d. Limitations and/or restrictions
3. The student may list any three of the following:
 - a. Concept that IV therapy is reserved for seriously/critically ill
 - b. Fear of unknown
 - c. Previous traumatic IV therapy experience
 - d. Lack of or inappropriate patient preparation for procedure
 - e. Nature of underlying illness
 - f. Significance of the IV fluid therapy and relationship to illness
 - g. Patient's personal psychological resources
4. The student may list any five of the following:
 - a. Age
 - b. Individual's premorbid personality
 - c. Family relationships
 - d. Presence of other concerns
 - e. Previous experience with illness and pain
 - f. Relationship with members of health care team
5.
 - a. Autonomic nervous system (vasovagal reaction)
 1. Vasodilation
 2. Drop in arterial blood pressure
 3. Syncope
 4. Diaphoresis
 - b. Cardiovascular system (pulmonary edema) - marked fluid retention and vascular overload
 - c. Emotional
 1. Dependent, regressive behavior
 2. Aggression

6.
 - a. Establish and maintain a good interpersonal rapport with patient/patient family.
 - b. Provide appropriate patient teaching.
 - c. Obtain order for stress-reducing medication when indicated.
 - d. Exhibit expertise in IV therapy procedures.
 - e. Reassurance of close monitoring
7.
 - a. Reaction to stress
 - b. Alteration in mental status
8. The student may list any three of the following:
 1. Provide diversional activities.
 2. Close monitoring of patient
 3. Use discrimination in selection of IV site.
 4. Assess possible alternative routes of medication administration.
 5. Behavior-modifying medications
 6. Use of restraints or safety mittens when indicated (use dependent on institutional policy)

LESSON PLAN: 2

COURSE TITLE: INTRAVENOUS FLUID THERAPY

UNIT VI ADMINISTRATION OF INTRAVENOUS FLUID THERAPY

SCOPE OF UNIT:

This unit discusses means to facilitate the process of intravenous fluid therapy administration for all patients, including the pediatric and geriatric patient. Recognition of specific psychological needs of the patient as well as intervention techniques are discussed, as are aspects of patient preparation. Safe and knowledgeable application of skills and techniques in identification of IV equipment, pre-administration preparation, and the actual initiation techniques of IV therapy are also included.

INFORMATION TOPIC: X OR DEMONSTRATION:

IDENTIFYING IV THERAPY EQUIPMENT
(Lesson Title)

LESSON OBJECTIVES - THE STUDENT WILL BE ABLE TO:

1. Define the following terms:
 - a. Gauge
 - b. Length
 - c. Lumen
2. List four considerations in the selection of an intravascular cannula.
3. Identify and recognize the advantages and disadvantages of the following types of cannulas:
 - a. Winged-tip
 - b. Over-the-needle
 - c. Through-the-needle
 - d. Inlying catheter
 - e. Multi-lumen venous catheter
 - f. Heparin lock

- g. Long-term access
 - h. Implanted intravascular drug delivery system
4. List three uses for a multi-lumen central venous catheter.
 5. State two uses for the heparin lock.
 6. State the primary advantage of the long-term access cannula.
 7. Describe minidrip, macrodrip, secondary and "Y"-set intravenous administration tubing.
 8. State the purpose of parenteral fluid and blood/blood component filters.
 9. Compare the advantages of plastic intravenous fluid containers to glass vacuum bottles.
 10. List four indications for consideration of electronic infusion device use.

SUPPLEMENTARY TEACHING/LEARNING ITEMS:

- I. HO I: Placement of Long-Term Catheter

INFORMATIONAL ASSIGNMENT:

Plumer, Ada Lawrence. Principles and Practice of Intravenous Therapy. 4th ed. Boston: Little, Brown & Co., 1987.

REFERENCES:

Plumer, Ada Lawrence. Principles and Practice of Intravenous Therapy. 4th ed. Boston: Little, Brown & Co., 1987.

Sager, Diane Proctor and Suzanne Kovarovic Bomar. Intravenous Medications: A Guide to Preparation, Administration and Nursing Management. Philadelphia: J.B. Lippincott Co., 1980, ch. 5.

INTRODUCTION:

Once an order for intravenous fluid therapy has been received and filled by the appropriate department, i.e., nursing, pharmacy, or central supply, the administering nurse must select the appropriate equipment to deliver the fluid correctly. Consideration must be given to type of fluid, expected duration of administration, purpose of administration, and patient's current clinical status. Selection of appropriate equipment results in safe and efficient delivery of ordered therapy.

LESSON PLAN: 2

COURSE TITLE: INTRAVENOUS FLUID THERAPY

UNIT VI ADMINISTRATION OF INTRAVENOUS FLUID THERAPY

OUTLINE: (Key Points)

I. Cannulas

A. Measurements of needles and catheters (II-1)

1. Gauge - diameter size of needle
2. Length - length of needle, hub to tip
3. Lumen - size of opening

B. Selection of intravascular cannula depends on

1. Types of fluids to be infused
2. Anticipated duration of therapy
3. Patient's clinical condition
4. Condition/size of patient's veins
5. Age of patient
6. Specific physician order

C. Types of cannula

1. Winged-tip needle

- a. Short, small gauge needle with one or two plastic side arms or wings
- b. Size - 19-27 gauge; usually 3/4" long
- c. Use - short-term therapy for any patient, especially children, infants or anyone with fragile veins
- d. Advantages
 - (1) Wings enable easy insertion and securing
 - (2) Less phlebitis

- e. Disadvantages
 - (1) Decreased mobility due to rigidity of device
 - (2) Increased infiltration risk
- 2. Over-the-needle catheter (ONC)
 - a. Catheter mounted on a needle
 - b. Size - 10-27 gauge; length 3/4"-3"
 - c. Use - active or moderately agitated patients who require a secure venous line
 - d. Advantages
 - (1) Less prone to infiltrate
 - (2) Allows more mobility than winged-tip needles
 - e. Disadvantages
 - (1) More likely to cause phlebitis
 - (2) Can kink if inserted in area of flexion without armboard application
 - (3) May emboli if improper techniques employed during insertion
- 3. Through-the-needle catheter (INC)
 - a. Catheter inside lumen of needle; needle removed leaving catheter
 - b. Size - gauge, length varies
 - c. Use
 - (1) Moderate to long-term therapy
 - (2) Administration of hypertonic fluids/irritating drugs which must be given via a central vein to insure adequate dilution
 - (3) CVP monitoring
 - (4) Critical care situations such as codes

d. Advantages

- (1) Very secure - often sutured to skin
- (2) Available in lengths to go to a central vein via peripheral vein

e. Disadvantages

- (1) Greater risk of infection
- (2) May emboli if:
 - (a) Improper technique is employed during insertion
 - (b) Needle guard is omitted when use is indicated
- (3) Central venous insertion requires physician

4. Inlying catheter (cutdown)

- a. Catheter requiring minor surgical procedure by physician for placement (cutdown)
- b. Size - 14-26 gauge; length varies
- c. Use - unavailable percutaneous access
- d. Advantages
 - (1) Assured access to vein during emergencies
 - (2) Very secure
- e. Disadvantages
 - (1) Physician to insert
 - (2) Requires consent form
 - (3) Creates surgical wound - increased risk of infection
 - (4) Results in skin and vein scarring

5. Multi-lumen central venous catheter

- a. French polyurethane central venous catheter containing three internal lumens
- b. Size of internal lumens
 - (1) 18 gauge (proximal)
 - (2) 18 gauge (middle)

- (3) 16 gauge (distal)
- c. Use - for patients requiring multiple IV lines for:
 - (1) Continuous or intermittent drug infusion
 - (2) Hyperalimentation
 - (3) CVP monitoring
 - (4) Blood administration
 - (5) Venous blood sampling
 - (6) Simultaneous infusions of incompatible drugs/fluids
- d. Recommended lumen use
 - (1) Proximal (18 gauge)
 - (a) Obtaining blood samples
 - (b) Administration of medications
 - (c) Blood administration
 - (2) Middle (18 gauge)
 - (a) TPN (or capped and maintained as a heparin lock for later use)
 - (b) Medications (only if TPN is not used or anticipated)
 - (3) Distal (16 gauge)
 - (a) CVP monitoring
 - (b) Blood administration
 - (c) Increase volume fluids
 - (d) Colloids (amphotericin)
 - (e) Medications
- e. Insertion site
 - (1) Right or left internal jugular vein
 - (2) Right or left external jugular vein
 - (3) Right or left subclavian

(4) Femoral vein

(NOTE: Site will not assure that the tip of the catheter will reach the inferior vena cava.)

- f. Maintenance patency - heparinization with dilute heparin holding solution

6. Intermittent infusion devices (heparin lock)

a. Capped cannula

b. Types

- (1) ONC with resealable medication port
- (2) Winged-tip infusion set with resealable cap
- (3) Any type of existing cannula with add-on injection cap

(NOTE: Cap should be Luer-Lok™.)

c. Uses

- (1) Ordered intermittent therapy
- (2) Provision of immediate intravascular access

d. Advantages

- (1) Avoidance of multiple venous punctures
- (2) Prompt venous access
- (3) Decreased fluid overload potential
- (4) Economical
- (5) Increased comfort and mobility

e. Disadvantages

- (1) Occurrence of clotting if not flushed with heparinized saline
- (2) Risk of emboli if not properly maintained
- (3) Risk of drug incompatibility to heparin

7. Long-term access cannula (Hickman™, Broviac™, Hirsch™, Arrow™) (HO I)

a. Size

- (1) Length - varies 65 cm - 90 cm
 - (2) Gauge - 2.7 French - 19.2 French
- b. Lumens
 - (1) Single lumen
 - (2) Bi-lumen
 - (3) Multi-lumen
- c. Use - long-term vascular access
- d. Advantages - can be left in place indefinitely
- e. Disadvantages
 - (1) Increased potential for infection
 - (2) Needs to be heparinized at least daily when not in use
 - (3) Catheter can be damaged
 - (4) Potential for occlusion
 - (5) May cause psychological distress from an aesthetic standpoint
 - (6) Requires placement by surgeon
- 8. Implanted intravascular drug delivery system (Port-A-Cath™, Medi-Port™, Infuse-A-Port™, etc.)
 - a. Components
 - (1) Radiopaque silicone rubber catheter
 - (2) Self-sealing portal septum
 - b. Use - patients requiring long-term and repeated access to venous system
 - c. Advantages
 - (1) Completely implanted
 - (2) No dressing required during periods of non-accessibility
 - (3) Heparinization only every 28 days during periods of non-usage

(4) Minimal interference with lifestyle

(5) Cosmetically pleasing

d. Disadvantages

(1) Risk of occlusion

(2) Risk of infection

(3) Requires surgical implantation

(4) Requires skilled, knowledgeable personnel to access

II. Tubing

(II-2)

A. Minidrip (microdrip)

1. Delivers very small amounts over a long period of time

2. Metal minitip where drop is formed

3. Forms very small drops

4. Delivers 60 gtts/ml

5. May or may not contain in-line filter

B. Macrodrop (venoset, solution administration set)

1. Can deliver different drip rates per cc due to different sized gtts

2. Travenol™ 10 gtt/cc; Abbott™, Cutter™, and Mc Gaw™ 15 gtts/cc

C. Secondary administration set

1. Use - for administration of fluids and medicants with primary line sets that contain a back flow check valve

2. Must be hung higher than primary line to prevent back-flow

D. Blood administration "Y"-set

1. Use - for administration of blood/blood components

2. Indications - has filter and line for saline flush

E. Specialty administration sets

1. Non-PVC sets for nitroglycerin infusions

2. Fat emulsion sets

3. Designated sets for specific pumps and controllers
4. Calibrated volume control sets

III. Filters

(II-3)

A. Parenteral fluid filters

1. Types
 - a. Integral
 - b. Add-on
 - c. Filter aspiration needles
2. Use - to prevent infusion of particulate matter
3. Sizes
 - a. 5 micron
 - b. 0.5 micron
 - c. 0.22 micron
4. Air passage capability
 - a. Air passing
 - b. Air blocking
 - c. Air eliminating
5. Advantages
 - a. Prevention of particulate matter
 - b. Prevention of air emboli
6. Disadvantages
 - a. Shouldn't filter < 5 ml sol or < 5 mg drug
 - b. Certain drugs/solutions should not be filtered
 - c. Possible touch contamination with add-on filter
 - d. Pressure limitations
 - e. Added cost

B. Blood/blood component filters

1. Types

- a. Integral
- b. Add-on

2. Use - to remove unwanted particulate matter

3. Sizes

- a. Standard blood filter - 170 micron
- b. Microaggregate blood filter - 20 to 40 micron
- c. Platelet filter

4. Advantages

- a. Prevention of delivery of particulate matter
- b. Prevention of infusion of substantial clots

5. Disadvantages

- a. May be difficult to prime
- b. May slow flow rate

IV. Containers

(II-3)

A. Glass bottles - vacuum bottles

1. Types

- a. Vented
- b. Non-vented

2. Advantages

- a. Certain drugs/solutions cannot be placed in plastic containers
- b. Presence of vacuum easily determined

3. Disadvantages

- a. Possibility of breakage - potential harm to patient if container breaks
- b. Heavy

- c. Increased storage space and disposal space
- d. Risk of airborne contamination

B. Flexible plastic bags - closed system

1. Types

- a. Large volume
- b. Minibags
- c. Blood/blood components containers

2. Advantages

- a. Light weight
- b. Unbreakable
- c. Easily stored and disposed of
- d. No venting required
- e. Diminished risk of airborne contamination

3. Disadvantages

- a. Difficult to ascertain volume remaining in container
- b. Possible contamination by accidental puncture
- c. Protective outer wrap may be difficult to remove

V. Electronic Infusion Devices

(II-4)

A. Purpose - to electronically control the administration of intravenous or intraarterial solution at a prescribed rate

B. Indication considerations

- 1. Critical medicant dosing
- 2. Anesthetics
- 3. Arterial drug delivery
- 4. Severe fluid restriction
- 5. High volume infusions
- 6. Neonatal infusions

7. Total parenteral nutrition
 8. Continuous/intermittent chemotherapy
- C. Types
1. Positive pressure pumps
 - a. Drop counting
 - b. Volumetric
 - c. Syringe
 - d. Peristaltic
 - e. Implantable
 - f. Patient controlled device (PCD)
 2. Electronic controllers
 - a. Drop counting
 - b. Volumetric
 3. Combined device - can be adjusted to be either volumetric infusion pump or gravity volumetric controller
- D. Infusion rate range - varies with type device, model, and manufacturer
- E. Alarm systems - may include but is not limited to:
1. Occlusion
 2. Air in-line
 3. Infusion complete
 4. Low battery
 5. Operating
 6. Malfunction
 7. Open door
- F. Required equipment
1. Uses standard administration sets
 2. Requires designated set

VI. Summary and Conclusion

- A. Cannulas
- B. Tubing
- C. Filters
- D. Containers
- E. Electronic infusion devices

LESSON PLAN: 2

COURSE TITLE: INTRAVENOUS FLUID THERAPY

UNIT VI ADMINISTRATION OF INTRAVENOUS FLUID THERAPY

INTERACTION ITEMS:

1. Why must a nurse be aware of the different types of cannulas available?
2. Is it really necessary for a nurse to be familiar with the tubing available?
3. Why are container differences so important to be aware of?
4. Why should a nurse be knowledgeable of infusion devices?

CLASSROOM, LABORATORY, OR OTHER ACTIVITIES:

1. Observe and handle cannulas, tubing, and containers.
2. Students to bring guidelines for using their employing institutions electronic infusion devices.

LESSON PLAN: 2

COURSE TITLE: INTRAVENOUS FLUID THERAPY

UNIT VI ADMINISTRATION OF INTRAVENOUS FLUID THERAPY

EVALUATION ITEMS:

1. Define the following terms related to needles and catheters:

- a. Gauge -
- b. Length -
- c. Lumen -

2. List four considerations in the selection of an intravascular cannula.

- a.
- b.
- c.
- d.

3. Match the following types of cannulas to the proper description:

- | | |
|--|---|
| ☐ a. Winged-tip | 1. Catheter inside needle lumen; needle removed leaving catheter |
| ☐ b. Over-the-needle (ONC) | 2. Capped cannula |
| ☐ c. Through-the-needle (INC) | 3. Short, small gauge needle with 1 or 2 plastic side arms or wings |
| ☐ d. Inlying catheter | 4. Completely implanted long-term venous device |
| ☐ e. Multi-lumen venous catheter | 5. Catheter requiring cutdown by physician for placement |
| ☐ f. Heparin lock | 6. Used for long-term vascular access can be left in place indefinitely |
| ☐ g. Long-term access (Hickman, Broviac, Hirsch, Arrow) | 7. Catheter mounted on a needle; needle removed once catheter is inserted |
| ☐ h. Implanted intravascular drug delivery system (Port-A-Cath, Medi-Port, Infuse-A-Port) | 8. Catheter containing three internal lumens for patients requiring multiple IV lines |

Select the best answer for each of the following:

- ___ 4. The advantage or advantages of a winged-tip needle are:
- Decreased infiltration risk
 - Wings enable easy insertion and securing
 - Increased phlebitis
 - Mobility is increased
- ___ 5. The disadvantages of the over-the-needle catheter (ONC) are:
- More likely to cause phlebitis
 - More prone to infiltrate
 - May emboli if improper insertion technique used
 - May kink if inserted in area of flexion without armboard application
- 1, 2, 4
 - 1, 3, 4
 - All of the above
- ___ 6. An inlying (cutdown) catheter:
- Requires minor surgery by a physician for placement
 - Provides venous access when percutaneous access is unavailable
 - Is very secure
 - Creates a surgical wound increasing the risk of infection
- 1, 2, 4
 - 1, 3, 4
 - All of the above
- ___ 7. Advantages of a heparin lock include:
- Decreased drug incompatibility to heparin
 - Avoidance of multiple venous punctures
 - Prompt venous access
 - Decreased concern of clotting and emboli
- 2, 3, 4
 - 1, 4
 - 2, 3
- ___ 8. The disadvantage(s) of a long-term access cannula include(s) (Hickman, Broviac, Hirsch, Arrow)
- Increased potential for infection
 - Psychological distress from aesthetic standpoint
 - Requires placement by surgeon
 - Potential for occlusion
- 1, 3
 - 1, 2, 3, 4
 - 2, 4

- 9. The advantages of an implanted intravascular drug delivery system (Port-A-Cath, Medi-Port, Infuse-A-Port) include:
1. Only needs to be heparinized daily when not in use (q 28 days)
 2. Psychological distress from aesthetic standpoint
 3. No dressing required during periods of nonaccess
 4. Minimal interference with lifestyle
 - a. 3, 4
 - b. 1, 2
 - c. All of the above
- 10. The advantage(s) of flexible plastic bag fluid containers as compared to glass-vacuum bottle fluid containers include:
1. Lighter weight
 2. Unbreakable
 3. Presence of vacuum easily determined
 4. Easily stored and disposed of
 - a. 1, 2, 3
 - b. 1, 2, 4
 - c. All of the above
11. List three uses for a multi-lumen central venous catheter.
- a.
 - b.
 - c.
12. State two uses for a heparin lock.
- a.
 - b.
13. State the advantage of a long-term access cannula (Hickman, Broviac, Arrow, Hirsch).
14. State the purpose of parenteral fluid and blood/blood component filters.

15. List four indications for consideration of electronic infusion device use.

- a.
- b.
- c.
- d.

16. Match the following types of IV tubing to the proper description.

- | | | | |
|--------|---|----|---|
| ___ a. | Minidrip (Microdrip) | 1. | Used for administration fluids and medicants with primary line |
| ___ b. | Macro drip (Venoset, solution administration set) | 2. | Delivers very small amounts over a long period of time |
| ___ c. | Secondary administration | 3. | Used for administration of blood/blood components |
| ___ d. | "Y"-set | 4. | Can deliver different drip rates per cc due to different sized gtts |

LESSON PLAN: 2

COURSE TITLE: INTRAVENOUS FLUID THERAPY

UNIT VI ADMINISTRATION OF INTRAVENOUS FLUID THERAPY

ANSWERS TO EVALUATION ITEMS:

1.
 - a. Diameter size of needle
 - b. Length of the needle from hub to tip
 - c. Size of opening
2. The student may list any four of the following:
 - a. Type of fluids to be infused
 - b. Anticipated duration of therapy
 - c. Patient's clinical condition
 - d. Condition/size of patient's veins
 - e. Age of patient
 - f. Specific physician order
3.

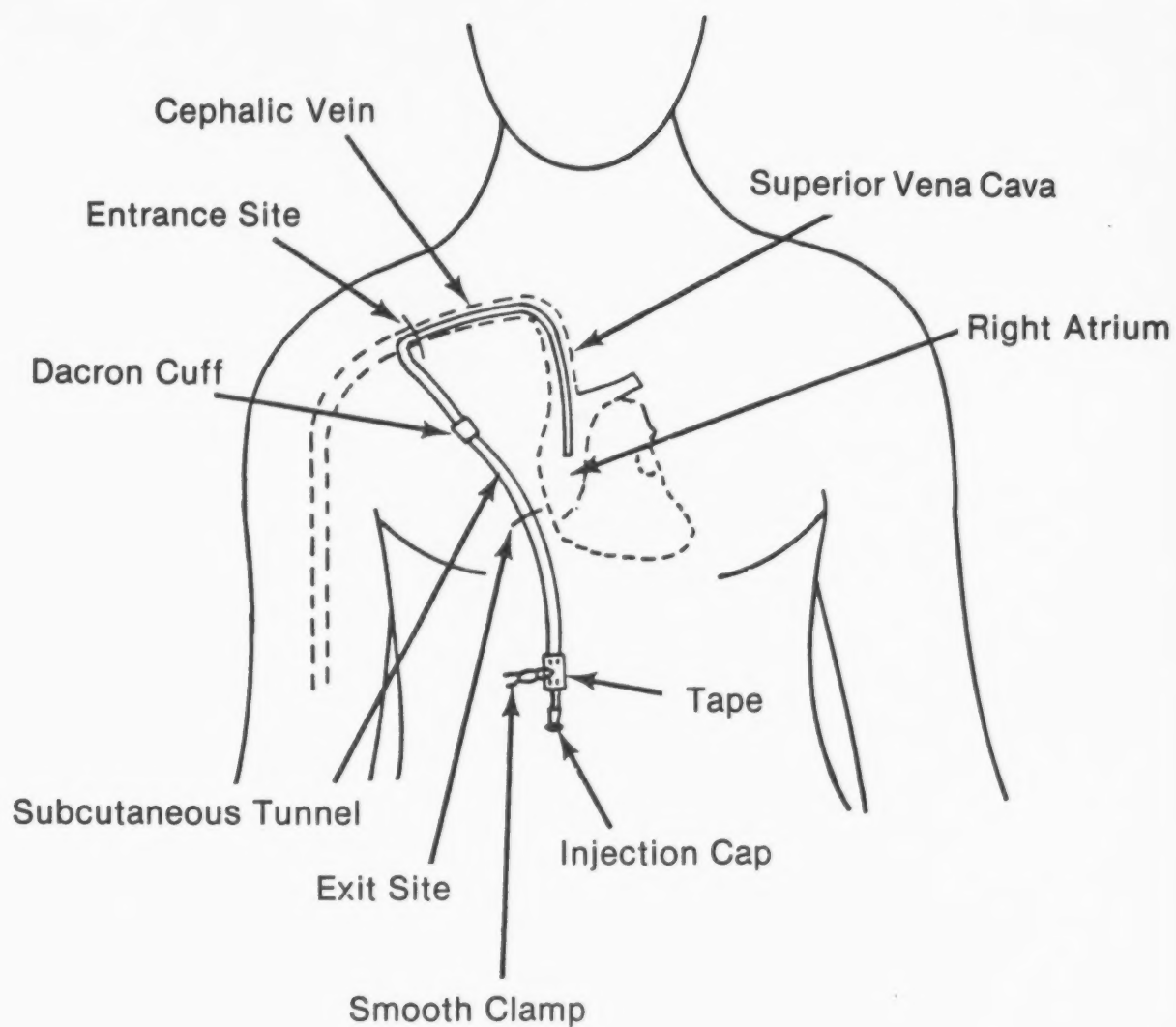
a.	3	e.	8
b.	7	f.	2
c.	1	g.	6
d.	5	h.	4
4. b
5. b
6. c
7. c
8. b
9. a
10. b
11. The student may list any three of the following:
 - a. Continuous or intermittent drug infusion
 - b. Hyperalimentation
 - c. CVP monitoring
 - d. Venous blood sampling
 - e. Simultaneous infusions of incompatible drugs/fluids
12.
 - a. Ordered intermittent therapy
 - b. Provision of immediate intravascular access
13. Can be left in place indefinitely
14. To prevent infusion of particulate matter

15. The student may list any four of the following:

- a. Critical medicant dosing
- b. Anesthetics
- c. Arterial drug delivery
- d. Severe fluid restriction
- e. High volume infusions
- f. Neonatal infusion
- g. Total parenteral nutrition
- h. Chemotherapy

16. a. 2
b. 4
c. 1
d. 3

Placement of Long-Term Catheter



LESSON PLAN: 3

COURSE TITLE: INTRAVENOUS FLUID THERAPY

UNIT VI ADMINISTRATION OF INTRAVENOUS FLUID THERAPY

SCOPE OF UNIT:

This unit discusses means to facilitate the process of intravenous fluid therapy administration for all patients, including the pediatric and geriatric patient. Recognition of specific psychological needs of the patient as well as intervention techniques are discussed, as are aspects of patient preparation. Safe and knowledgeable application of skills and techniques in identification of IV equipment, pre-administration preparation, and the actual initiation techniques of IV therapy are also included.

INFORMATION TOPIC: OR DEMONSTRATION: X

PREPARATION FOR THE ESTABLISHMENT OF THE INTRAVENOUS LINE
(Lesson Title)

LESSON OBJECTIVES - THE STUDENT WILL BE ABLE TO:

1. Collect equipment for instituting IV therapy according to the steps of procedure.
2. Assemble equipment according to the steps of procedure.
3. Prepare patient according to the steps of procedure.

SUPPLEMENTARY TEACHING/LEARNING ITEMS:

1. Cannulas
2. Tubing and tubing change label
3. Container of solution
4. IV standard
5. Tape
6. Alcohol - skin bactericidal
7. Antimicrobial agent

8. Time strip
9. Dressing
10. Pen
11. Tourniquet
12. Control device, if applicable
13. Protective gloves
14. Puncture-proof container

INFORMATIONAL ASSIGNMENT:

Plumer, Ada Lawrence. Principles and Practice of Intravenous Therapy. 4th ed. Boston: Little, Brown & Co., 1987.

REFERENCES:

Plumer, Ada Lawrence. Principles and Practice of Intravenous Therapy. 4th ed. Boston: Little, Brown & Co., 1987.

Sager, Diane Proctor and Suzanne Kovarovic Bomar. Intravenous Medications: A Guide to Preparation, Administration and Nursing Management. Philadelphia: J.B. Lippincott Co., 1980, ch. 3.

INTRODUCTION:

After verification of written IV therapy orders, ascertaining allergy history, assessing clinical status and medical history, subsequent steps in providing ordered therapy include collecting needed supplies and assembling equipment in an appropriate location. In order to decrease the patient's anxiety and to encourage cooperation, efforts will be employed to meet the psychological needs of each individual patient.

LESSON PLAN: 3

COURSE TITLE: INTRAVENOUS FLUID THERAPY

UNIT VI ADMINISTRATION OF INTRAVENOUS FLUID THERAPY

STEPS OF PROCEDURE:

I. Collect Equipment

A. Container of solution

1. Verify type and volume of solution ordered.
2. Verify accuracy of added medicants and amount ordered.
3. Check expiration date of solution.
4. If using glass bottles, check for chips and/or cracks.
5. If using flexible bags, gently squeeze to detect any leaks.
6. Observe for clarity of solution and presence of particulate matter.

B. Administration set tubing and label

NOTE: Verify drop factor.

C. Venipuncture equipment

(II-1)

1. Cannula
2. Skin bactericidal
3. Antimicrobial agent
4. 2x2 gauze or transparent dressing
5. Tape
6. Tourniquet
7. Protective gloves
8. Puncture-proof container

D. Electronic infusion device, if applicable

E. IV standard

II. Assemble Equipment

- A. Wash hands.
- B. Remove container cover and discard, if applicable.
- C. Remove administration set tubing from box.
- D. Close roller control clamp.
- E. Insert administration set spike into container.
- F. Squeeze chamber to fill at least 1/3.
- G. Open clamp slightly and allow tubing to fill slowly while inverting med-ports and tapping to clear air.
- H. Close roller clamp.
- I. Tape time strip to solution container to indicate rate of flow.
- J. Label administration set with time and date for change and initials.
- K. Suspend from IV standard or connect to infusion control device, if applicable.

III. Patient Interaction

- A. Identify patient.
- B. Validate allergy history.
- C. Alleviate patient's concerns by explaining and answering questions regarding:
 - 1. Purpose of therapy
 - 2. Procedure to be employed
 - 3. Equipment to be used
 - 4. Limitations/restrictions related to IV therapy
 - 5. Demonstrate ambulation, if applicable.

IV. Summary and Conclusion

- A. Ask interaction items.
- B. Review steps of procedure.

LESSON PLAN: 3

COURSE TITLE: INTRAVENOUS FLUID THERAPY

UNIT VI ADMINISTRATION OF INTRAVENOUS FLUID THERAPY

EVALUATION ITEMS: NAME OF STUDENT: _____

PREPARATION FOR THE ESTABLISHMENT OF THE INTRAVENOUS LINE

EQUIPMENT:

- | | |
|-----------------------------------|-----------------------------------|
| 1. Cannulas | 8. Antimicrobial agent |
| 2. Tubing and tubing change label | 9. Time strip |
| 3. Container of solution | 10. Dressing |
| 4. IV standard | 11. Pen |
| 5. Tape | 12. Tourniquet |
| 6. Alcohol - skin bactericidal | 13. Control device, if applicable |
| 7. Protective gloves | 14. Puncture-proof container |

DID THE STUDENT:	YES	NO
1. Collect equipment.		
2. Verify type and amount of solution ordered.		
3. Verify accuracy of added medicants and amount ordered.		
4. Check expiration date of solution.		
5. Check glass bottles for chips and/or cracks.		
6. Squeeze flexible bags to detect leaks.		
7. Observe for clarity of solution and presence of particulate matter.		
8. Wash hands.		
9. Remove container cover and discard, if applicable.		
10. Remove administration set tubing from box.		
11. Close roller control clamp.		
12. Insert administration set spike into container.		
13. Squeeze chamber to fill at least 1/3.		
14. Open clamp slightly and allow tubing to fill slowly while inverting med-ports and tapping to clear air.		

DID THE STUDENT:	YES	NO
15. Close roller clamp.		
16. Tape time strip to solution container to indicate rate of flow.		
17. Label administration set tubing with time and date for change and initials.		
18. Suspend from IV standard or connect to infusion control device, if applicable.		
19. Identify patient.		
20. Validate allergy history.		
21. Alleviate patient's concerns by explaining and answering questions regarding:		
a. Purpose of therapy		
b. Procedure to be employed		
c. Equipment to be used		
d. Limitations/restrictions related to IV therapy		
e. Demonstrate ambulation, if applicable.		

The student has satisfactorily completed the procedure "PREPARATION FOR THE ESTABLISHMENT OF THE INTRAVENOUS LINE" according to the steps outlined.

Instructor's/Charge Personnel's Signature
(Verifying Satisfactory Completion)

Date

LESSON PLAN: 4

COURSE TITLE: INTRAVENOUS FLUID THERAPY

UNIT VI ADMINISTRATION OF INTRAVENOUS FLUID THERAPY

SCOPE OF UNIT:

This unit discusses means to facilitate the process of intravenous fluid therapy administration for all patients, including the pediatric and geriatric patient. Recognition of specific psychological needs of the patient as well as intervention techniques are discussed, as are aspects of patient preparation. Safe and knowledgeable application of skills and techniques in identification of IV equipment, pre-administration preparation, and the actual initiation techniques of IV therapy are also included.

INFORMATION TOPIC: OR DEMONSTRATION: X

INSERTION OF THE INTRAVENOUS OVER-THE-NEEDLE CANNULA
(Lesson Title)

LESSON OBJECTIVE - THE STUDENT WILL BE ABLE TO:

1. Insert intravenous over-the-needle cannula according to the steps of procedure.

SUPPLEMENTARY TEACHING/LEARNING ITEMS:

1. HO 1: Factors to Consider in Selecting a Vein
2. HO 2: Palpating Veins
3. Trainex #588: "Performing the Venipuncture"
4. Anatomical Model
5. Equipment and supplies collected and assembled for Lesson Plan 3 of this unit

INFORMATIONAL ASSIGNMENT:

Plumer, Ada Lawrence. Principles and Practice of Intravenous Therapy. 4th ed. Boston: Little, Brown & Co., 1987, ch. 12.

REFERENCES:

Plumer, Ada Lawrence. Principles and Practice of Intravenous Therapy. 4th ed. Boston: Little, Brown & Co., 1987, ch. 12.

Sager, Diane Proctor and Suzanne Kovarovic Bomar. Intravenous Medications: A Guide to Preparation, Administration and Nursing Management. Philadelphia: J.B. Lippincott Co., 1980, ch. 5.

INTRODUCTION:

Knowledge, skills, and ability are the necessary ingredients for the performance of a successful venipuncture.

LESSON PLAN: 4

COURSE TITLE: INTRAVENOUS FLUID THERAPY

UNIT VI ADMINISTRATION OF INTRAVENOUS FLUID THERAPY

STEPS OF PROCEDURE:

I. Prerequisites:

- A. Identify patient.
- B. Control of environment
 - 1. Provide privacy.
 - 2. Adjust lighting.
 - 3. Adjust height of bed if needed.
- C. Wash hands.

II. Evaluation For Potential Sites

- A. Assess patient.
 - 1. CVA
 - 2. Radical mastectomy or other pertinent surgery
 - 3. History of drug abuse
 - 4. Prior cutdown
 - 5. Arthritis
- B. Selection of vein (HO 1)
 - 1. Apply tourniquet.
 - 2. Apply measures to dilate vein.
 - 3. Palpate vein. (HO 2)
 - 4. Release tourniquet.

III. Placement of Supplies

- A. Easy accessibility
- B. Placed in sequential order of use

1. Open cannula package.
2. Tear tape.
3. Prepare dressing.

IV. Skin Preparation

- A. Place protective paper towel or cloth under proposed site.
- B. Clip excessive hair.
- C. Apply tourniquet.
- D. Palpate vein.
- E. Cleanse site with bactericidal agent.
 1. Center to periphery
 2. Over at least one minute, with friction
 3. Allow to dry.

V. Put on Protective Gloves

VI. Insertion of Cannula

- A. Inform patient of stick.
- B. Aseptically insert cannula, bevel up.
- C. Ascertain blood return.
- D. Advance stylet (needle) slightly.
- E. Advance catheter.
- F. Release tourniquet.
- G. Remove stylet (needle) while occluding vein with digital pressure to minimize blood spillage
- H. Place stylet in puncture-proof container
- I. Aseptically connect administration set to cannula hub.
- J. Initiate flow of infusion slowly.
- K. Observe for sign of infiltration.
- L. Anchor cannula with tape according to manufacturer's guidelines.

- M. Apply antimicrobial agent to site.
- N. Apply dressing and secure with tape.
- O. Remove gloves.
- P. Apply label to dressing.
 - 1. Type, gauge and length of cannula
 - 2. Date and time
 - 3. Initials/name of person performing venipuncture
- Q. Regulate flow rate to coincide with ordered rate.
- R. Advise patient of restrictions, precautions.
- S. Dispose of used equipment and rubbish according to institutional policy.
- T. Charge for supplies used.
- U. Document procedure.

VII. Summary and Conclusion

- A. Ask interaction items.
- B. Review steps of procedure.

LESSON PLAN: 4

COURSE TITLE: INTRAVENOUS FLUID THERAPY

UNIT VI ADMINISTRATION OF INTRAVENOUS FLUID THERAPY

INTERACTION ITEMS:

1. Why should a nurse consider the patient's past medical history when instituting IV therapy?
2. What things should a nurse consider when selecting a vein?
3. Why is skin preparation necessary?

CLASSROOM, LABORATORY, OR OTHER ACTIVITIES:

1. Apply tourniquet to different students and apply measures to dilate veins they would select for IV fluid therapy administration.
2. Practice palpating dilated veins.
3. Insert cannula into vein of anatomical model.

LESSON PLAN: 4

COURSE TITLE: INTRAVENOUS FLUID THERAPY

UNIT VI ADMINISTRATION OF INTRAVENOUS FLUID THERAPY

EVALUATION ITEMS: NAME OF STUDENT: _____

INSERTION OF THE INTRAVENOUS OVER-THE-NEEDLE CANNULA

EQUIPMENT:

1. Equipment and supplies collected and assembled for lesson plan 3 of this unit

DID THE STUDENT:	YES	NO
1. Identify the patient.		
2. Control the environment.		
a. Provide privacy.		
b. Adjust lighting.		
c. Adjust height of bed if needed.		
3. Wash hands.		
4. Assess patient's medical/surgical history.		
5. Based on assessment, select vein.		
6. Apply tourniquet.		
7. Apply measures to dilate vein.		
8. Palpate vein.		
9. Release tourniquet.		
10. Arrange supplies in order of sequential use in accessible place.		
a. Open cannula package.		
b. Tear tape.		
c. Prepare dressing.		

DID THE STUDENT:	YES	NO
11. Place protective paper towel or cloth under proposed site.		
12. Clip excessive hair.		
13. Apply tourniquet.		
14. Palpate vein.		
15. Cleanse site.		
a. Clean center to periphery.		
b. Clean for at least one minute with friction.		
c. Allow to dry.		
16. Put on protective gloves.		
17. Inform patient of stick.		
18. Aseptically insert stylet, bevel up.		
19. Ascertain blood return.		
20. Advance stylet slightly.		
21. Advance catheter.		
22. Release tourniquet.		
23. Remove stylet while applying digital pressure.		
24. Place stylet in puncture-proof container.		
25. Aseptically connect administration set to cannula hub.		
26. Initiate flow of infusion slowly.		
27. Observe for sign of infiltration.		
28. Anchor cannula with tape according to manufacturer's guidelines.		
29. Apply antimicrobial agent to site.		
30. Apply dressing and secure with tape.		
31. Remove gloves.		

DID THE STUDENT:	YES	NO
32. Apply label to dressing.		
a. Type, gauge and length of cannula		
b. Date and time		
c. Initials/name		
33. Regulate flow rate per ordered rate.		
34. Advise patient of restrictions, precautions.		
35. Dispose of used equipment and rubbish according to institutional policy.		
36. Charge for supplies used.		
37. Document procedure.		

The student has satisfactorily completed the procedure "INSERTION OF THE INTRAVENOUS OVER-THE-NEEDLE CANNULA" according to the steps outlined.

Instructor's/Charge Personnel's Signature
(Verifying Satisfactory Completion)

Date

Factors to Consider in Selecting a Vein

1. PURPOSE OF THE INFUSION
 - a. To Correct Fluid and Electrolyte Imbalance
 - b. Drug Therapy
 - c. As a Preventive Measure
 - d. To Administer Blood or Blood Products
2. DURATION OF THERAPY
3. CONDITION OF VEINS
4. SUITABLE LOCATION FOR THE PARTICULAR STYLE OF NEEDLE SELECTED

Palpating Veins

It is extremely important to develop a sensitivity for palpating veins. Merely inserting a needle and hoping for the best is **not** a sound approach.

If you are a right-handed person continual use of the left forefinger for palpation will increase your sensitivity.

Never use the thumb for palpating -- it is not as sensitive and you may feel your own pulse, mistaking it for the patient's.

Measures Aiding Distension of Veins

1. Pause a few minutes after tourniquet is applied to allow the vein to fill
2. Ask patient to open and close hand a few times
3. Lightly patting the vein
4. Allow arm to hang down over the side of the bed
5. Application of heat to the arm

LESSON PLAN: 5

COURSE TITLE: INTRAVENOUS FLUID THERAPY

UNIT VI ADMINISTRATION OF INTRAVENOUS FLUID THERAPY

SCOPE OF UNIT:

This unit discusses means to facilitate the process of intravenous fluid therapy administration for all patients, including the pediatric and geriatric patient. Recognition of specific psychological needs of the patient as well as intervention techniques are discussed, as are aspects of patient preparation. Safe and knowledgeable application of skills and techniques in identification of IV equipment, pre-administration preparation, and the actual initiation techniques of IV therapy are also included.

INFORMATION TOPIC: OR DEMONSTRATION: X

INSERTION OF THE INTRAVENOUS WINGED-TIP NEEDLE
(Lesson Title)

LESSON OBJECTIVE - THE STUDENT WILL BE ABLE TO:

1. Insert intravenous winged-tip needle according to the steps of procedure.

SUPPLEMENTARY TEACHING/LEARNING ITEMS:

1. HO 1: Factors to Consider in Selecting a Vein (See Lesson Plan 4 of this unit)
2. HO 2: Palpating Veins (See Lesson Plan 4 of this unit)
3. Anatomical Model
4. Winged-tip needle samples
5. Dressing
6. Antimicrobial agent
7. Tape
8. Tourniquet

9. Alcohol sponges
10. Protective gloves

INFORMATIONAL ASSIGNMENT:

Plumer, Ada Lawrence. Principles and Practice of Intravenous Therapy. 4th ed. Boston: Little, Brown & Co., 1987.

REFERENCES:

Plumer, Ada Lawrence. Principles and Practice of Intravenous Therapy. 4th ed. Boston: Little, Brown & Co., 1987.

West, Richard Samuel. Book ed., Managing IV Therapy Nursing Photobook. Springhouse, PA: Springhouse Corporation, 1983.

INTRODUCTION:

Knowledge, skills, and ability are the necessary components for the performance of a successful venipuncture.

LESSON PLAN: 5

COURSE TITLE: INTRAVENOUS FLUID THERAPY

UNIT VI ADMINISTRATION OF INTRAVENOUS FLUID THERAPY

STEPS OF PROCEDURE:

I. Prerequisites

- A. Identify patient.
- B. Control of environment
 - 1. Provision of privacy
 - 2. Adjust lighting.
 - 3. Adjust height of bed, if needed.
- C. Wash hands.

II. Evaluation for Potential Sites

- A. Assess patient.
 - 1. CVA
 - 2. Radical mastectomy or other pertinent surgery
 - 3. History of drug abuse
 - 4. Prior cutdown
 - 5. Arthritis
- B. Selection of vein

NOTE: Refer to HO 1 from Lesson Plan 4 of this unit

- 1. Apply tourniquet.
- 2. Apply measures to dilate vein.
- 3. Palpate vein.

NOTE: Refer to HO 2 from Lesson Plan 4 of this unit

- 4. Release tourniquet.

III. Placement of Supplies

- A. Easy accessibility
- B. Placed in sequential order of use
 - 1. Tear tape.
 - 2. Prepare dressing.

IV. Skin Preparation

- A. Place protective paper towel or cloth under proposed site.
- B. Clip excessive hair.
- C. Apply tourniquet.
- D. Palpate vein.
- E. Cleanse site with bactericidal agent.
 - 1. Center to periphery
 - 2. Over at least one minute with friction
 - 3. Allow to dry.

V. Priming Winged-Tip Needle of Air

- A. Aseptically attach winged-tip needle to administration set tubing.
- B. Open flow clamp and allow fluid to disperse air from winged-tip needle.
- C. Close flow control clamp to stop fluid flow.

VI. Put on Protective Gloves

VII. Insertion of Winged-Tip Needle

- A. Inform patient of stick.
- B. Remove the needle cap.
- C. Pinch the wings together tightly and aseptically insert needle, bevel up.
- D. Ascertain blood return in winged-tip needle tubing.
- E. Continue to advance the needle until it is well within the vein.
- F. Release tourniquet.
- G. Initiate flow of infusion and observe for free flow and/or signs of infiltration.

H. Secure winged-tip needle with tape using the "H" method.

1. Place one strip of tape over each wing, keeping the tape parallel to the needle.
2. Place another strip of tape perpendicular to the first two directly on top of the wings.

CAUTION: Do not allow tape to cover actual insertion site.

I. Apply antimicrobial agent to insertion site.

J. Apply dressing and secure with tape.

K. Remove gloves.

L. Apply a label to the dressing:

1. Type, gauge and length of winged-tip needle
2. Date and time
3. Initials/name of person performing venipuncture

M. Regulate flow rate to coincide with ordered rate.

N. Advise patient of restrictions/precautions.

O. Dispose of used equipment and trash according to institutional policy.

P. Charge for supplies used.

Q. Document procedure.

VIII. Summary and Conclusion

A. Ask interaction items.

B. Review steps of procedure.

LESSON PLAN: 5

COURSE TITLE: INTRAVENOUS FLUID THERAPY

UNIT VI ADMINISTRATION OF INTRAVENOUS FLUID THERAPY

INTERACTION ITEMS:

CLASSROOM, LABORATORY, OR OTHER ACTIVITIES:

LESSON PLAN: 5

COURSE TITLE: INTRAVENOUS FLUID THERAPY

UNIT VI ADMINISTRATION OF INTRAVENOUS FLUID THERAPY

EVALUATION ITEMS

NAME OF STUDENT: _____

INSERTION OF THE INTRAVENOUS WINGED-TIP NEEDLE

EQUIPMENT:

1. Anatomical model
2. Winged-tip needle samples
3. Dressing
4. Antimicrobial agent
5. Tape
6. Tourniquet
7. Alcohol sponges
8. Protective gloves

DID THE STUDENT:	YES	NO
1. Identify patient.		
2. Control the environment.		
a. Provide privacy.		
b. Adjust lighting.		
c. Adjust height of bed, if needed.		
3. Wash hands.		
4. Assess patient's surgical/medical history.		
5. Based on assessment, select vein.		
6. Apply tourniquet.		
7. Apply measures to dilate vein.		
8. Palpate vein.		
9. Release tourniquet.		

DID THE STUDENT:		YES	NO
10.	Arrange supplies in order of sequential use in accessible place.		
	a. Open cannula package.		
	b. Tear tape.		
	c. Prepare dressing.		
11.	Prime winged-tip needle of air.		
	a. Aseptically attach winged-tip needle of administration set tubing.		
	b. Open flow clamp and allow fluid to disperse air from cannula.		
	c. Close flow control clamp.		
12.	Place protective paper towel or cloth under proposed site.		
13.	Clip excessive hair.		
14.	Apply tourniquet.		
15.	Palpate vein.		
16.	Cleanse site.		
	a. Clean center to periphery.		
	b. Clean for at least one minute with friction.		
	c. Allow to dry.		
17.	Put on protective gloves.		
18.	Insert winged-tip needle.		
	a. Inform patient of stick.		
	b. Remove needle cap.		
	c. Pinch wings together and aseptically insert bevel up.		
	d. Ascertain blood return in winged-tip needle tubing.		
	e. Advance needle to point well within the vein.		
19.	Release tourniquet.		

DID THE STUDENT:	YES	NO
20. Initiate flow of infusion and observe for free flow and/or infiltration.		
21. Secure with tape using "H" method or occlusive dressing.		
22. Apply antimicrobial agent to insertion site.		
23. Apply dressing and secure with tape.		
24. Remove gloves.		
25. Apply label to dressing.		
a. Type, gauge and length of cannula		
b. Date and time		
c. Initials/name		
26. Regulate flow rate per ordered rate.		
27. Advise patient of restrictions, precautions.		
28. Dispose of used equipment and rubbish according to institutional policy.		
29. Charge for supplies used.		
30. Document procedure.		

The student has satisfactorily completed the procedure "INSERTION OF THE INTRAVENOUS WINGED-TIP NEEDLE" according to the steps outlined.

Instructor's/Charge Personnel's Signature
(Verifying Satisfactory Completion)

Date

LESSON PLAN: 6

COURSE TITLE: INTRAVENOUS FLUID THERAPY

UNIT VI ADMINISTRATION OF INTRAVENOUS FLUID THERAPY

SCOPE OF UNIT:

This unit discusses means to facilitate the process of intravenous fluid therapy administration for all patients, including the pediatric and geriatric patient. Recognition of specific psychological needs of the patient as well as intervention techniques are discussed, as are aspects of patient preparation. Safe and knowledgeable application of skills and techniques in identification of IV equipment, pre-administration preparation, and the actual initiation techniques of IV therapy are also included.

INFORMATION TOPIC: OR DEMONSTRATION: X

INSERTION OF A HEPARIN LOCK
(Lesson Title)

LESSON OBJECTIVE - THE STUDENT WILL BE ABLE TO:

1. Insert/convert to a heparin lock according to the steps of procedure.

SUPPLEMENTARY TEACHING/LEARNING ITEMS:

1. Anatomical model
2. Winged-tip heparin lock
3. Over-the-needle catheter (ONC)
4. Injection cap
5. Syringe containing normal saline
6. Syringe containing heparinized saline
7. Tape
8. Dressing
9. Alcohol sponges

10. Tourniquet
11. Protective glasses
12. Puncture-proof container

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INFORMATIONAL ASSIGNMENT:

Plumer, Ada Lawrence. Principles and Practice of Intravenous Therapy. 4th ed. Boston: Little, Brown & Co., 1987.

REFERENCES:

Plumer, Ada Lawrence. Principles and Practice of Intravenous Therapy. 4th ed. Boston: Little, Brown & Co., 1987.

INTRODUCTION:

The insertion of a heparin lock provides immediate venous accessibility for the intermittent administration of intravenous medications. Placement of a heparin lock is advantageous because it negates the trauma of multiple punctures, conserves veins, offers freedom of movement between transfusions and minimizes the potential for circulatory overload.

LESSON PLAN: 6

COURSE TITLE: INTRAVENOUS FLUID THERAPY

UNIT VI ADMINISTRATION OF INTRAVENOUS FLUID THERAPY

STEPS OF PROCEDURE:

I. Principles

- A. Aseptic technique must be employed.
- B. Clear air from devices prior to use:
 - 1. Injection caps
 - 2. Winged-tip heparin locks
- C. To maintain patency of the cannula during dormant periods, heparinized saline must be instilled into the cannula.
- D. Never flush with sterile water. Water, which is hypotonic, causes hemolysis if given intravenously.
- E. All flushes are done over time period of one (1) minute.
 - 1. Prevents venous spasm
 - 2. Flush remains in cannula and cannula tubing.

II. Steps of Procedure

A. Prerequisites

- 1. Identify patient.
- 2. Control of environment
 - a. Provision of privacy
 - b. Adjust lighting.
 - c. Adjust height of bed, if needed.
- 3. Wash hands.

B. Evaluation for potential sites

- 1. Assess patient.
 - a. CVA

- b. Radical mastectomy or other pertinent surgery
 - c. History of drug abuse
 - d. Prior cutdown
 - e. Arthritis
 - 2. Selection of vein
 - a. Apply tourniquet.
 - b. Apply measures to dilate vein.
 - c. Palpate vein.
 - d. Release tourniquet.
- C. Placement of supplies
 - 1. Easy accessibility
 - 2. Placed in sequential order of use
 - a. Open cannula package.
 - b. Tear tape.
 - c. Prepare dressing.
- D. Skin preparation
 - 1. Place protective paper towel or cloth under proposed site.
 - 2. Clip excessive hair.
 - 3. Apply tourniquet.
 - 4. Palpate vein.
 - 5. Cleanse site with bacteriocidal agent.
 - a. Center to periphery
 - b. Over at least one minute, with friction
 - c. Allow to dry.
- E. Insertion of winged-tip heparin lock
 - 1. Wash hands.
 - 2. Explain procedure to patient.

3. Cleanse injection cap with alcohol over one (1) minute.
4. Flush air from tubing segment and needle of winged-tip heparin lock by the aseptic injection of sufficient normal saline to achieve that purpose.
5. Prepare dressing.
6. Put on protective gloves.
7. Inform patient of stick.
8. Pinch the wings together tightly and aseptically insert needle, bevel up.
9. Ascertain blood return in winged-tip heparin lock tubing.
10. Continue to advance the needle until it is well within the vein.
11. Release tourniquet.
12. Place strip of tape perpendicular to the wings of the device.
13. Cleanse injection cap with alcohol and inject one (1) ml of normal saline over one (1) minute while observing for infiltration.
14. Once patency is ascertained, aseptically inject one (1) ml of heparinized saline over one (1) minute.
15. Place one strip of tape horizontally over each of the wings parallel to the needle.

CAUTION: Do not allow tape to cover actual insertion site.

16. Apply antimicrobial agent to injection site (dependent upon institutional policy).
17. Apply dressing.
18. Remove gloves.
19. Apply label to dressing.
 1. Type, gauge, and length of heparin lock
 2. Date and time
 3. Initials/name of person performing venipuncture
20. Advise patient of restrictions/precautions.
21. Dispose of rubbish according to institutional policy.

22. Charge for supplies used.
23. Document procedure.
- F. Insertion of over-the-needle catheter (ONC)/immediate conversion to heparin lock
 1. Wash hands.
 2. Cleanse injection cap with alcohol over one (1) minute.
 3. Flush air from injection cap by the aseptic injection of sufficient normal saline to achieve this purpose.
 4. Prepare dressing and tear tape.
 5. Put on protective gloves.
 6. Inform patient of stick.
 7. Aseptically insert catheter, bevel up.
 8. Ascertain blood return.
 9. Advance stylet (needle) slightly.
 10. Advance catheter.
 11. Release tourniquet.
 12. Remove stylet (needle) while applying digital pressure to minimize blood spillage.
 13. Place stylet in puncture-proof container.
 14. Securely attach injection cap to catheter hub.
 15. Anchor cannula with tape according to manufacturer's recommendations.

CAUTION: Do not allow tape to cover actual insertion site.
 16. Cleanse injection cap with alcohol over one (1) minute.
 17. Inject one (1) ml of normal saline over one (1) minute while observing for infiltration. Once patency is ascertained, aseptically inject one (1) ml heparinized saline over one (1) minute.
 18. Apply antimicrobial agent to injection site (dependent upon institutional policy).
 19. Apply dressing.

20. Remove gloves.
21. Apply label to dressing.
 1. Type, gauge, and length of cannula
 2. Date and time
 3. Name/initials of person performing venipuncture
22. Advise patient of restrictions/precautions.
23. Dispose of contaminated equipment and rubbish according to approved institutional policy.
24. Charge for supplies used.
25. Document procedure.

III. Summary and Conclusion

- A. Ask interaction items
- B. Review steps of procedure.

LESSON PLAN: 6

COURSE TITLE: INTRAVENOUS FLUID THERAPY

UNIT VI ADMINISTRATION OF INTRAVENOUS FLUID THERAPY

INTERACTION ITEMS:

1. Why must the heparin lock contain heparinized saline during dormant periods?
2. Why must saline and/or heparinized saline be injected over a one (1) minute time span?
3. Why must patency of the heparin lock be ascertained?

CLASSROOM, LABORATORY, OR OTHER ACTIVITIES:

1. Insert winged-tip heparin lock.
2. Insert over-the-needle catheter (ONC) and convert to a heparin lock.
3. Flush heparin lock with saline.
4. Flush heparin lock with heparinized saline.

LESSON PLAN: 6

COURSE TITLE: INTRAVENOUS FLUID THERAPY

UNIT VI ADMINISTRATION OF INTRAVENOUS FLUID THERAPY

EVALUATION ITEMS

NAME OF STUDENT: _____

INSERTION OF A HEPARIN LOCK

EQUIPMENT:

1. Anatomical model
2. Winged-tip heparin lock
3. Over-the-needle catheter (ONC)
4. Injection cap
5. Syringe containing normal saline
6. Syringe containing heparinized saline
7. Tape
8. Dressing
9. Alcohol sponges
10. Tourniquet
11. Protective gloves
12. Puncture-proof container
13. Antimicrobial agent

DID THE STUDENT:	YES	NO
1. Identify the patient.		
2. Control the environment.		
a. Provide privacy.		
b. Adjust lighting.		
c. Adjust height of bed, if needed.		
3. Wash hands.		
4. Assess patient's surgical/medical history.		
5. Based on assessment, select vein.		
6. Apply tourniquet.		
7. Apply measures to dilate vein.		
8. Palpate vein.		

DID THE STUDENT:		YES	NO
9.	Release tourniquet.		
10.	Arrange supplies in order of sequential use in accessible place.		
	a. Open cannula package.		
	b. Tear tape.		
	c. Prepare dressing.		
11.	Place protective paper towel or cloth under proposed site.		
12.	Clip excessive hair.		
13.	Apply tourniquet.		
14.	Palpate vein.		
15.	Cleanse site.		
	a. Clean center to periphery.		
	b. Clean for at least one minute with friction.		
	c. Allow to dry.		
16.	Insert winged-tip heparin lock.		
	a. Put on protective gloves.		
	b. Explain procedure to patient.		
	c. Cleanse injection cap with alcohol over one (1) minute.		
	d. Aseptically flush air from tubing and needles of heparin lock with N/S.		
	e. Prepare dressing.		
	f. Inform patient of stick.		
	g. Pinch wings together and insert needle, bevel up.		
	h. Ascertain blood return and advance needle into vein.		
	i. Release tourniquet.		
	j. Place tape perpendicular to wings of device.		

THE STUDENT:		YES	NO
k.	Cleanse injection cap with alcohol and inject one (1) ml N/S over one (1) minute, observing for infiltration.		
l.	After ascertaining patency, aseptically inject one (1) ml heparinized saline over one (1) minute.		
m.	Tape wings and apply antimicrobial agent to site.		
n.	Remove gloves.		
o.	Apply label and dressing.		
p.	Advise patient of restrictions/precautions.		
q.	Dispose of equipment.		
r.	Document procedure.		
17.	Insert ONC catheter/immediate conversion to heparin lock.		
a.	Wash hands.		
b.	Cleanse injection cap with alcohol over one (1) minute.		
c.	Aseptically flush air from injection cap with N/S.		
d.	Prepare dressing.		
e.	Put on protective gloves.		
f.	Inform patient of stick.		
g.	Aseptically insert catheter, bevel up.		
h.	Ascertain blood return.		
i.	Advance stylet slightly.		
j.	Advance catheter.		
k.	Release tourniquet.		
l.	Remove stylet.		
m.	Place stylet in puncture-proof container.		
n.	Securely attach injection cap to catheter hub.		
o.	Anchor cannula with tape.		

DID THE STUDENT:	YES	NO
p. Cleanse injection cap with alcohol one (1) minute.		
q. Inject one (1) ml N/S over one (1) minute while observing for infiltration.		
r. Once patency is ascertained, aseptically inject one (1) ml heparinized saline over one (1) minute.		
s. Apply antimicrobial agent to site and apply dressing.		
t. Remove gloves.		
u. Apply labels.		
a. Type, gauge and length of cannula		
b. Date and time		
c. Name/initials		
v. Advise patient of restrictions/precautions.		
w. Dispose of equipment.		
x. Document procedure.		

The student has satisfactorily completed the procedure "INSERTION OF A HEPARIN LOCK" according to the steps outlined.

Instructor's/Charge Personnel's Signature
(Verifying Satisfactory Completion)

Date

LESSON PLAN: 7
COURSE TITLE: INTRAVENOUS FLUID THERAPY
UNIT VI ADMINISTRATION OF INTRAVENOUS FLUID THERAPY

SCOPE OF UNIT:

This unit discusses means to facilitate the process of intravenous fluid therapy administration for all patients, including the pediatric and geriatric patient. Recognition of specific psychological needs of the patient as well as intervention techniques are discussed, as are aspects of patient preparation. Safe and knowledgeable application of skills and techniques in identification of IV equipment, pre-administration preparation, and the actual initiation techniques of IV therapy are also included.

INFORMATION TOPIC: X OR DEMONSTRATION:

PRINCIPLES OF PEDIATRIC INTRAVENOUS FLUID THERAPY
(Lesson Title)

LESSON OBJECTIVES - THE STUDENT WILL BE ABLE TO:

1. Identify principles of pediatric fluid and electrolyte balance.
2. Match equipment and site selections to the proper statements.
3. Identify principles of nursing care of the pediatric patient.
4. Name two daily records on the chart of the pediatric IV patient for which the nurse is responsible.
5. State purpose of administering only preservative-free heparin flush to neonates.
6. List two pediatric-specific IV therapy procedures.

SUPPLEMENTARY TEACHING/LEARNING ITEMS:

1. Volume-control administration sets

INFORMATIONAL ASSIGNMENT:

Plumer, Ada Lawrence. Principles and Practice of Intravenous Therapy. 4th ed. Boston: Little, Brown & Co., 1987.

REFERENCES:

Plumer, Ada Lawrence. Principles and Practice of Intravenous Therapy. 4th ed. Boston: Little, Brown & Co., 1987.

Sager, Diane Proctor and Suzanne Kovarovic Bomar. Intravenous Medications: A Guide to Preparation, Administration and Nursing Management. Philadelphia: J. B. Lippincott Co., 1980, ch. 6.

Metheny, Norma M. Fluid and Electrolyte Balance, Nursing Considerations. Philadelphia: J. B. Lippincott Co., 1987, ch. 29.

Nursing '80 PhotoBook Series. Managing IV Therapy. Horsham, PA: Intermed Communications Inc., 1980, pp. 46, 57, 148-150.

INTRODUCTION:

The nurse who is responsible for any aspect of intravenous drug therapy for the pediatric patient must be keenly aware of the differences in social and emotional needs, the stage of psychosocial development, anatomical differences, and therapeutic dose range. This awareness allows the nurse to deliver drug therapy safely and effectively.

LESSON PLAN: 7

COURSE TITLE: INTRAVENOUS FLUID THERAPY

UNIT VI ADMINISTRATION OF INTRAVENOUS FLUID THERAPY

OUTLINE: (Key Points)

- I. Definition by Age of the Pediatric Patient
 - A. Newborn - 0-4 weeks
 - B. Infant - 4 weeks - 1 year
 - C. Toddler - 1-3 years
 - D. Preschool - 3-5 years
 - E. School age - 6-12 years
 - F. Adolescent - 13-18 years
- II. Psychological Considerations of Intravenous Therapy in Pediatric Patients (II-I)
 - A. Explain procedure and provide support.
 - I. For the child
 - a. Understandable terminology
 - b. Base on child's age, developmental stage and level, and previous knowledge and expectations.
 - (1) Young infants (1-3 months)
 - (a) Possess a built-in stimulus barrier that causes reactive delays and possibly reduces sensitivity
 - (b) Intellectual level and lack of experience tend to minimize fear and anxiety.
 - (c) Restricted movement; prolonged discomfort, and deep painful stimuli cause distress
 - (d) Gentle handling, stroking, and a soothing voice can provide some comfort during and after procedure.
 - (2) Older infants (up to 12 months)

- (a) Generally anticipate pain - cry, struggle, and wiggle
 - (b) Parents may be helpful in comforting children of this age.
 - (c) Support given by stroking and verbal reassurance in soothing voice
- (3) Toddlers (1-3 years) and preschool children (3-5 years)
- (a) Reactions are influenced by previous experiences and fantasies as well as by cognitive functioning.
 - (b) Language limitations may result in physical expressions of fear, crying, striking at nurse, pulling away.
 - (c) Play therapy with objects of care as applied to self or doll
 - (d) Tell child pain will occur with procedure.
 - (e) Tell child it is all right to cry with procedure, but set limitations of motion.
 - (f) Reassure child of not being alone during procedure.
- (4) School age children (6-12 years)
- (a) Child has intellectual capacity to understand the purpose of procedure and technique used.
 - (b) Will be able to cooperate when he/she knows what behavior is expected
 - (c) Allow time for verbalization of fears and concerns.
 - (d) Play therapy may assist in dramatizing fears and/or concerns, as may simple anatomical drawings or readings about the procedure.
 - (e) Allow time to familiarize child with procedure and equipment.
 - (f) Give truthful and appropriate explanation.
 - (g) Time preparation of child so it is adequate but not too far in advance to allow for unnecessary worry.

- (5) Adolescents (13-18 years)
 - (a) Information given is similar to that of adult.
 - (b) Particularly concerned about body image; threatened by illness and helplessness
 - (c) Detail truthful explanations as much as necessary.
- c. Encourage to express his/her version of what is going to occur
- d. Provide child with a sense of control by allowing choices when possible.
 - (1) What side to use
 - (2) How they can/want to help
 - (3) Listen to what they have to say
- e. Acknowledge and accept fears - assurance that it is all right to be afraid and to cry
- 2. For the parents
 - a. Include parents when procedure is explained to child; may act as liaison
 - b. Assess parent-child interaction to determine effectiveness of parents in supporting the child.
 - c. If parents desire, allow them to assist in caring for child.
 - (1) Question parent(s) regarding ability to cope during physical presence while procedure is being performed on child.
 - (2) Stress importance of emotional and physical comfort to child during and after procedure.
 - (3) Do not ask parent(s) to restrain child or participate in any way with venipuncture.
- B. Insertion of IV cannula should be done in treatment room.
 - 1. Allows child to associate bed and room with comfort and security.
 - 2. Physically removed from other pediatric patients
- C. Post-procedure
 - 1. Praise behavior.

2. Allow child to talk about or play out feelings.

III. Principles of Pediatric Fluid and Electrolyte Balance Relevant to IV Therapy (11-2)

- A. The younger the child, the greater the risk of fluid and electrolyte imbalance as well as fluid overload and congestive heart failure. Many frequently ordered medications contain considerable amounts of electrolytes.
- B. Pediatric patients have immature homeostatic regulating mechanisms.
- C. A young child has a larger body surface in relation to weight resulting in greater fluid losses than the adult.
- D. Metabolic rate is about three times faster than the adult which increases water requirements greatly.
- E. Pediatric patients have a tendency to develop metabolic acidosis.

IV. Equipment Selection for the Pediatric Patient

A. Cannula

1. Winged-tip needle unit (butterfly, scalp-vein needle)

- a. Neonate - 25-27 G
- b. Older child - 23-25 G
- c. Size depends on
 - (1) Age
 - (2) Size
 - (3) Fluids to be administered
 - (4) Site

2. Inlying catheter (cutdown) - 22G
3. ONC and/or INC
4. Umbilical - radiopaque catheters Fr 3.5, 5.0 or 8.0

B. Containers

1. Plastic is recommended - if glass container is used, it should be cushioned.
2. Smaller volume
 - a. Infants - 250 ml maximum

- b. Less than 12 years old - 500 ml maximum
 - c. Over 12 years old - same as adult
- C. Administration set - pediatric infusion set (volume-control set)
 - 1. Used for all children under 12 years
 - 2. If volume-control sets unavailable, microdrip (minidrip) sets through age 12
 - 3. For newborns and infants, fill volume-control chamber with no more than one third of the day's requirement each time
- D. Electronic flow control devices may be used for delivery of ordered therapy.
 - 1. Flow rate should be tenths of ml, if possible
 - 2. Should be tamper-proof
 - 3. Should know accuracy of device (10% deviation could result in a major problem with infant/small child)

CAUTION: Does not take place of nurse

V. Pediatric Infusion Sites

A. Peripheral veins

- 1. Dorsal hand veins
 - a. Often preferred - allows for mobility
 - b. Avoid using dominant hand or thumb-sucking hand.
- 2. Dorsal foot veins and flexion surfaces of the wrist
 - a. May need only grasp of an assistant around extremity instead of a tourniquet.
 - b. Immobilize extremity with padded board but always maintain normal joint configuration.
- 3. Antecubital fossa
 - a. Generally unsatisfactory as hard to immobilize
 - b. More favorable in older children
 - c. Use armboard or sandbag to immobilize joint.

- d. Allow child to select arm to be used.
- e. Allows mobility
- 4. Scalp veins
 - a. Often used in neonates and young infants up to approximately one year.
 - b. Sites:
 - (1) Superficial temporal
 - (2) Supraorbital
 - (3) Posterior auricular
 - (4) Facial veins
 - c. To dilate, place head lower than rest of body which will usually cause crying. Crying, along with lowered head, will help raise scalp veins.
 - d. Can create psychological distress for parents
 - e. Must be well-protected to prevent dislodgement

B. Central veins

- 1. External jugular for infants and toddlers
- 2. Subclavian for the older child

VI. Nursing Care

A. Maintenance of flow rate

- 1. Appropriate equipment
 - a. Pediatric infusion set
 - b. Minidrip solution administration set
- 2. Regulate flow rate while patient is at rest; crying constricts vessels. (II-3)
- 3. Constant rate must be maintained - fluctuating rate may result in erratic blood glucose or overhydration resulting in congestive heart failure and/or pulmonary edema.
- 4. Infusion pump must be used with umbilical arterial catheter to maintain an infusion pressure greater than aortic pressure.

B. Assess patient.

1. General condition

- a. Assess IV site every half hour.
- b. Activity/behavior
- c. Nature of cry
- d. Vital signs
- e. Fontanelles
- f. Skin turgor
- g. Physical appearance

2. Observe for complications.

- a. Irritability
- b. Lethargy
- c. Pallor
- d. Changes in bowel movements
- e. Changes in vital signs
- f. Redness and swelling at site
- g. Decreased urinary output
- h. Acute weight loss or gain (5%)
- i. Absence of tears and salivation
- j. Specific to scalp vein site
 - (1) Facial and head asymmetry
 - (2) Sloughing and necrosis with infiltration of hypertonic solutions

C. Keep accurate intake and output record.

1. Intake

- a. Hourly record of type and amount fluid received
- b. Running totals
 - (1) Rate of flow

- (2) Amount of fluid added to chamber
 - (3) Amount of fluid remaining in bottle/chamber
 - 2. Output
 - a. Record urinary output.
 - (1) Urine collecting container
 - (2) Weighing diaper
 - b. Accurate record of blood withdrawn for lab
 - c. Record amounts, color, and characteristics of drainage, stools, emesis.
- D. Provide accurate daily weight record.
 - 1. Same scale
 - 2. Same time of day
 - 3. Same amount of clothing
- E. Know normal lab values

VII. Special Pediatric Procedures

- A. Umbilical catheterization
 - 1. Performed by surgeon
 - 2. Used for emergency IV therapy when peripheral access unachievable
 - 3. Insertion successful up to three days of life
 - 4. Can be left in place 3 - 7 days
- B. Exchange blood transfusion
 - 1. Done in erythroblastosis fetalis usually caused by Rh or ABO incompatibility between mother and baby
 - 2. Performed by physician

VIII. Heparin Flush Strengths

- A. Pediatrics
 - 1. 10 units/ml
 - 2. Frequency of administration is dependant upon ordered therapy

B. Neonates

1. Should be preservative-free flush solution - benzyl alcohol preservative is toxic to neonates
2. Frequency of administration dependant upon ordered therapy

IX. Summary and Conclusion

- A. Definition by age of pediatric patient
- B. Psychological considerations of intravenous therapy in pediatric patients
- C. Pediatric principles of fluid and electrolytes relevant to IV therapy
- D. Equipment selection for the pediatric patient
- E. Pediatric infusion sites
- F. Nursing care
- G. Special pediatric procedures
- H. Heparin flush strengths

LESSON PLAN: 7

COURSE TITLE: INTRAVENOUS FLUID THERAPY

UNIT VI ADMINISTRATION OF INTRAVENOUS FLUID THERAPY

INTERACTION ITEMS:

1. What factors influence the level of anxiety in the pediatric patient?
2. Why is it important to discuss pediatric principles of fluid and electrolyte balance?
3. Why are constant flow rates critical in the pediatric patient?

CLASSROOM, LABORATORY, OR OTHER ACTIVITIES:

1. Role-play preparing the parents of an infant for upcoming IV therapy.
2. Practice filling volume-control set with proper amounts for different age patients.

LESSON PLAN: 7

COURSE TITLE: INTRAVENOUS FLUID THERAPY

UNIT VI ADMINISTRATION OF INTRAVENOUS FLUID THERAPY

EVALUATION ITEMS:

For each of the following, write "T" if the statement is true, or "F" if it is false.

- _____ 1. The younger the child, the greater the risk of fluid electrolyte imbalance.
- _____ 2. Due to a child's increased metabolism, small amounts of excess fluid will not cause an imbalance of fluids and electrolytes.
- _____ 3. Even newborns have mature homeostatic regulatory mechanisms.
- _____ 4. A young child has a smaller body surface in relation to weight than the adult.
- _____ 5. A larger body surface results in greater fluid loss.
- _____ 6. The metabolic rate for a young child is about three times faster than the adult which decreases water needs greatly.
- _____ 7. Pediatric patients have a tendency to develop metabolic acidosis.
- _____ 8. Frequently-used drugs that contain considerable amounts of electrolytes are Keflin, Na, and K penicillin.

Match the information to the proper statement.

- | | |
|--|---------------------------|
| _____ 9. Use volume-control set or minidrip administration set: 500 ml volume maximum in container | a. Infants |
| | b. Less than 12 years old |
| _____ 10. Used through third day of life for emergency IV therapy when peripheral administration is not possible | c. Scalp veins |
| | d. Umbilical vessels |
| _____ 11. Most commonly used veins on infants | |
| _____ 12. Fill chamber with no more than one third of the day's requirement: 250 ml volume maximum in container | |
| 13. Name two daily records on the chart of the pediatric IV patient for which the nurse is responsible. | |

a.

b.

14. State purpose of administering only preservative-free heparin solution to neonates.
 - a.
 - b.
15. List two pediatric-specific IV procedures.
 - a.
 - b.

LESSON PLAN: 7

COURSE TITLE: INTRAVENOUS FLUID THERAPY

UNIT VI ADMINISTRATION OF INTRAVENOUS FLUID THERAPY

ANSWERS TO EVALUATION ITEMS:

1. T
2. F
3. F
4. F
5. T
6. F
7. T
8. T
9. b
10. d
11. c
12. a
13. a. Intake and output
b. Daily weight
14. Benzyl alcohol preservative is toxic to neonates.
15. a. Umbilical catheterization
b. Exchange blood transfusion

LESSON PLAN: 8

COURSE TITLE: INTRAVENOUS FLUID THERAPY

UNIT VI ADMINISTRATION OF INTRAVENOUS FLUID THERAPY

SCOPE OF UNIT:

This unit discusses means to facilitate the process of intravenous fluid therapy administration for all patients, including the pediatric and geriatric patient. Recognition of specific psychological needs of the patient as well as intervention techniques are discussed, as are aspects of patient preparation. Safe and knowledgeable application of skills and techniques in identification of IV equipment, pre-administration preparation, and the actual initiation techniques of IV therapy are also included.

INFORMATION TOPIC: X

OR

DEMONSTRATION: .

PRINCIPLES OF GERIATRIC INTRAVENOUS FLUID THERAPY
(Lesson Title)

LESSON OBJECTIVES - THE STUDENT WILL BE ABLE TO:

1. Identify age related differences of the geriatric patient.
2. Identify possible psychological changes of the geriatric patient.
3. Identify intravenous principles in site selection, cannula insertion, and IV maintenance of the geriatric patient.
4. List four IV therapy related conditions to observe for in the geriatric patient due to their increased risk of occurrence.

SUPPLEMENTARY TEACHING/LEARNING ITEMS:

INFORMATIONAL ASSIGNMENT:

REFERENCES:

Ebersole, Priscilla and Patricia Hess. Toward Healthy Aging - Human Needs and Nursing Response. St. Louis: C.V. Mosby, 1981, ch. 4.

Metheny, Norma M. Fluid and Electrolyte Balance, Nursing Considerations. Philadelphia: J.B. Lippincott Co., 1987, ch. 30.

INTRODUCTION:

There are four characteristics of aging — it is universal, progressive, decremental, and intrinsic. This is a normal process to all persons, but takes place at different times. The nurse administering intravenous fluid therapy must be aware of physical and psychological changes occurring with the geriatric patient.

LESSON PLAN: 8

COURSE TITLE: INTRAVENOUS FLUID THERAPY

UNIT VI ADMINISTRATION OF INTRAVENOUS FLUID THERAPY

OUTLINE: (Key Points)

I. Age Related Differences

A. Physiologic changes related to intravenous therapy (II-1)

1. Loss of tissue elasticity
 - a. Loss of skin integrity
 - b. Loss of resiliency and moisture
2. Elastic fibers fragment, split, straighten.
3. Calcium leaves the bones and is deposited in the vessels.
4. Lumen of vessels is decreased and causes blood flow to various organs to become uneven.
5. Cardiac muscle cells decrease in size, but heart appears larger due to narrowed and changed dimension of thoracic structure; reduces efficiency of heart muscle, decreases cardiac output.
6. Subcutaneous fat is lost.
7. Decreased ability to metabolize glucose

B. Possible psychological changes (II-2)

1. Senility - forgetfulness
2. Impairment - confusion
3. Depression

II. Intravenous Principles (II-3)

A. Use extreme caution in site selection

1. Least accessible site
2. Avoid dominant hand when possible

3. Least fragile vein
4. As much bone support under vein as possible
5. Metacarpal veins are not desirable as there is not enough subcutaneous tissue to support.

B. Insertion of cannula

1. More gentle prep of skin
2. Be aware of increased hematoma formation with contusion to area.
3. Observe closely for distention of veins due to increased venous pressure, eliminating need for standard tourniquet.
4. Observe for sclerosed veins.
5. Secure with paper tape or Kerlix due to skin fragility.

C. Maintenance

1. Observe at least once every hour.
2. Reorient patient to procedure frequently, if applicable.
3. Employ safety measures if indicated.
 - a. Armboard
 - b. Restraints
 - c. Protective gauze wrap

D. Observation - increased risk for

1. CHF
2. Pulmonary edema
3. Glycosuria
4. Injury due to self-removal of cannula
5. Infiltration
6. Hematoma

III. Summary and Conclusion

- A. Age-related differences
- B. Intravenous principles

LESSON PLAN: 8

COURSE TITLE: INTRAVENOUS FLUID THERAPY

UNIT VI ADMINISTRATION OF INTRAVENOUS FLUID THERAPY

INTERACTION ITEMS:

1. Why should the nurse be aware of the physical changes occurring with age?
2. Are psychological needs different for the aged?
3. How do these changes/differences affect intravenous therapy?

CLASSROOM, LABORATORY, OR OTHER ACTIVITIES:

1. Review signs and symptoms of complications for which the geriatric patient is at increased risk.

LESSON PLAN: 8

COURSE TITLE: INTRAVENOUS FLUID THERAPY

UNIT VI ADMINISTRATION OF INTRAVENOUS FLUID THERAPY

EVALUATION ITEMS:

For each of the following, write "T" if the statement is true, or "F" if it is false.

- ☐ 1. Age related differences between geriatric and younger adults do not alter IV administration to the geriatric patient in any way.
 - ☐ 2. Loss of tissue elasticity frequently occurs in the geriatric patient.
 - ☐ 3. In geriatric patients, the vein lumen often decreases in size.
 - ☐ 4. In older patients, the heart appears smaller but the efficiency of the heart muscle and cardiac output remain the same.
 - ☐ 5. As the adult grows older there is decreased ability to metabolize glucose.
 - ☐ 6. All geriatric patients exhibit some degree of senility.
 - ☐ 7. When initiating IV therapy, it is not necessary to explain the procedure to an already confused patient.
 - ☐ 8. Distention of veins due to increased venous pressure can eliminate the need for a standard tourniquet.
 - ☐ 9. Secure cannulas with paper tape or Kerlix due to skin fragility.
 - ☐ 10. Observe the IV site in the geriatric patient at least once every two hours.
11. Four IV therapy related conditions for which the geriatric IV patient is at increased risk are:
- a.
 - b.
 - c.
 - d.

LESSON PLAN: 8

COURSE TITLE: INTRAVENOUS FLUID THERAPY

UNIT VI ADMINISTRATION OF INTRAVENOUS FLUID THERAPY

ANSWERS TO EVALUATION ITEMS:

1. F
2. T
3. T
4. F
5. T
6. F
7. F
8. T
9. T
10. F
11. The student may list any four of the following:
 - a. CHF
 - b. Pulmonary edema
 - c. Glycosuria
 - d. Injury due to self-removal of cannula
 - e. Infiltration
 - f. Hematoma

LESSON PLAN: 1

COURSE TITLE: INTRAVENOUS FLUID THERAPY

UNIT VII INTRAVENOUS FLUID THERAPY MAINTENANCE

SCOPE OF UNIT:

This unit introduces the principles of maintaining and calculating intravenous flow rates and maintaining administration set components, including cannulas. Also included are: provision of safety measures; changing site dressings; maintaining heparin lock patency; and discontinuing intravenous therapy.

INFORMATION TOPIC: X OR DEMONSTRATION:

PRINCIPLES OF MAINTENANCE OF INTRAVENOUS FLUID THERAPY
(Lesson Title)

LESSON OBJECTIVES - THE STUDENT WILL BE ABLE TO:

1. List five hazards related to inaccurate infusion rate.
2. Identify principles involved in:
 - a. Maintenance of flow rate
 - b. Changing fluid containers
 - c. Changing administration set tubing components
 - d. Changing IV site dressings
 - e. Replacement of peripheral cannula
 - f. Changing entire intravenous system
 - g. Maintaining heparin lock patency
 - h. Monitoring heparin lock patency
3. Calculate flow rates using formulas for:
 - a. Millimeters per hour
 - b. Drops per minute

SUPPLEMENTARY TEACHING/LEARNING ITEMS:

1. HO 1: Factors That Alter Flow Rate
2. HO 2: Calculating Flow Rates
3. HO 1: CDC Guidelines for Prevention of Intravenous-Related Infections (from Unit V, Lesson Plan 2), Recommendations 7-12
4. AS 1: Calculations of IV Fluid
5. IV administration set
6. Electronic infusion devices
7. Intravenous cannula
8. PRN adaptors
9. Heparin flushes
10. Tubex or carpoject
11. IV anatomical models
12. IV care kit
13. Tape
14. Protective gloves
15. Puncture-proof container

INFORMATIONAL ASSIGNMENT:

Plumer, Ada Lawrence. Principles and Practice of Intravenous Therapy. 4th ed. Boston: Little, Brown & Co., 1987, chs. 5-6.

Sager, Diane Proctor and Suzanne Kovarovic Bomar. Intravenous Medications: A Guide to Preparation, Administration, and Nursing Management. Philadelphia: J. B. Lippincott Company, 1980, ch. 6.

Metheny, Norma M. Fluid and Electrolyte Balance: Nursing Considerations. Philadelphia: J.B. Lippincott Co., 1987, ch. 10.

REFERENCES:

Plumer, Ada Lawrence. Principles and Practice of Intravenous Therapy. 4th ed. Boston: Little, Brown & Co., 1987, chs. 5-6.

Sager, Diane Proctor and Suzanne Kovarovic Bomar. Intravenous Medications: A Guide to Preparation, Administration, and Nursing Management. Philadelphia: J. B. Lippincott Co., 1980, ch. 6.

U.S. Department of Health and Human Services. Intravascular Infections: Intravenous Therapy Related. Atlanta: Centers for Disease Control, 1982.

U.S. Department of Health and Human Services. Guideline for Handwashing and Hospital Environmental Control, 1985. Atlanta: Centers for Disease Control. Reprinted by Missouri Department of Health, #99-1117.

INTRODUCTION:

In order to administer IV therapy safely and effectively the nurse must be cognizant of the principles involved in calculating and maintaining flow rates and safe utilization of IV therapy-related equipment.

LESSON PLAN: I

COURSE TITLE: INTRAVENOUS FLUID THERAPY

UNIT VII INTRAVENOUS FLUID THERAPY MAINTENANCE

OUTLINE: (Key Points)

I. Maintenance of Flow Rate

(II-I)

- A. Prime consideration in the administration of parenteral solutions is the rate of flow. Fluids and medications must be infused at an appropriate rate and in a constant and accurate manner to achieve the desired therapeutic response and to prevent complications.
- B. Hazards related to inaccurate infusion rates
 - 1. Drug toxicity
 - 2. Delayed responses to drugs
 - 3. Pulmonary edema
 - 4. Metabolic disturbances
 - 5. Heightened potential for venous irritation and phlebitis
 - 6. Air embolism from dry containers
 - 7. Occluded cannula due to cessation of flow rate
- C. Factors affecting ordered rate of administration
 - 1. Pharmacological properties of the infusate
 - 2. Specific mode of administration
 - 3. Patient's condition and response
- D. Factors altering flow rate (HO I)
 - 1. Fluid
 - a. Viscosity
 - b. Temperature - coldness induces venous spasm
 - (1) Refrigerated fluid should be brought to room temperature before infusing.
 - (2) Do not hasten warming process by submerging in hot water.

2. Height of fluid container in relation to patient (only with gravity flow infusions)
 - a. Fluid container usually placed 30-36 inches above patient.
 - b. Raising the container increases flow rate.
 - c. Variation may occur with change in patient's position.
3. Administration set tubing
 - a. Clogged air vent with air-dependent containers
 - b. Slippage/loosening of flow control clamp
 - c. Kinking of tubing
 - d. Occluded filters
 - e. Tubing dangling below the bed
4. Cannula
 - a. Change of position of cannula in vein
 - b. Clot formation on cannula
 - (1) Temporary delay in infusion
 - (2) Increase in venous pressure with resultant blood flow back into cannula
 - (a) Blood pressure cuff on involved extremity
 - (b) Restraint placed on or above cannula
 - (c) Patient lying on arm receiving infusion
5. Electronic infusion devices
 - a. Decrease in flow rate when programmed total amount reached
 - b. Low battery
6. Trauma to vein
 - a. Phlebitis
 - b. Thrombosis
7. Infiltration - as degree of infiltration progresses slowing of infusion will result

8. Manipulative patient and/or relative

II. Calculation of Flow Rates

(II-2)

- A. Flow rate should be calculated and recorded each time a new container of fluid or dose of medicine is administered.
- B. Flow rate is expressed as volume of fluid delivered per unit of time.
1. The flow rate expressed in milliliters per hour is more accurate in monitoring volume delivered over a period of time. Calculate by dividing the volume of fluid to be infused in milliliters by the infusion time in hours.

Flow rate in ml/hours:

$$\frac{\text{Volume of fluid (in ml)}}{\text{Time to be infused (in hours)}}$$

$$\text{Ex: } \frac{1000 \text{ cc}}{8 \text{ hrs}} = 125 \text{ ml/hr}$$

2. To deliver desired hourly volume it is necessary to convert the flow rate into drops per minute. To achieve this one must know:
- a. Volume of fluid to be infused
- b. Total infusion time
- c. Drop factor of the administration set - number of gtts/ml
- (1) Standard set (dependent upon manufacturer) - delivers 10, 15, or 20 gtts per ml - allows higher flow
- (2) Micro set - delivers 60 gtts per ml - use for slower delivery over extended time
- d. Methods to calculate gtts/min
- (1) Flow rate (in drops/min) =
- $$\frac{\text{gtt factor}}{60 \text{ (min/hr)}} \times \frac{\text{volume/l hour}}{1} = \text{gtts/min}$$
- (a) With sets that deliver 10 gtts/ml, infuse 120 ml/hr:
- $$\frac{10}{60} \times \frac{120}{1} = 20 \text{ gtts/min}$$

- (b) With sets that deliver 15 gtts/ml, infuse 120 ml/hr:

$$\frac{15 \times 120}{60} = 30 \text{ gtts/min}$$

- (c) With sets that deliver 60 gtts/ml, infuse 120 ml/hr:

$$\frac{60 \times 120}{60} = 120 \text{ gtts/min}$$

- (2) Fluid method of calculation starts with the volume of fluid to be administered in one hour, for example, infuse 80 ml/hr

- (a) With sets that deliver 10 gtts/ml, divide the hourly volume by 6:

$$\frac{80 \text{ ml/hr}}{6} = 14 \text{ gtts/min}$$

- (b) With sets that deliver 15 gtts/ml, divide hourly volume by 4:

$$\frac{80 \text{ ml/hr}}{4} = 20 \text{ gtts/min}$$

- (c) With sets that deliver 60 gtts/ml the hourly volume or number of ml/hr equals the number of gtts per minute:

$$80 \text{ ml/hr} = 80 \text{ gtts/min}$$

- C. Once flow rate has been calculated, the rate in gravity infusion systems is set by adjusting the flow control clamp.

III. Changing Fluid Containers

(11-4)

A. Reasons

1. To add sequential container
2. To avoid exceeding the span restrictions.
 - a. Parenteral fluids should be discarded if not infused within 24 hours.
 - b. Lipid emulsions should be discarded if not infused within 12 hours.

- B. Labeling - all containers should be labeled with time and date they are opened.

IV. Changing Administration Set Tubing/Components

A. Reasons

1. Change in ordered therapy
 - a. Change in ordered flow rate
 - b. Change in fluid order
 - (1) Blood/blood component
 - (2) Lipid emulsions
 - (3) Nitroglycerine
 - c. Use of electronic control device
 2. To avoid exceeding time span restrictions
 - a. Administration sets should be changed every 24-48 hours.
 - (1) Peripheral site - every 48 hours
 - (2) Central venous sites - every 24 hours
 - b. IV piggyback administration sets should be changed every 24-48 hours (dependent upon institutional policy).
 - c. Administration sets used for total parenteral nutrition should be changed every 24 hours.
 3. Administration sets should be changed immediately after infusion of blood or blood components.
 4. The lipid emulsion infusion set is for one time use only.
- B. Labeling - the date and time the administration set should be changed should be indicated on a label attached to the set.
- C. All tubing junctions should be securely reinforced as with tape, Luer-Lok™, or clamping device.
- D. The time of changing administration set tubing should coincide with the hanging of a new container of fluid.
- E. Ascertain that administration set tubing is appropriate for ordered therapy.
1. Fluid
 2. Rate of flow
 3. Mode of administration

- F. Protective gloves should be worn by nurse during procedure.
- V. Changing IV Site Dressing (II-5)
 - A. Recommended routine changing of IV site dressing is every 24-72 hours
 - 1. Central venous site gauze dressing - every 24 hours
 - 2. Peripheral site dressing - every 48 hours
 - 3. Central venous site transparent dressing - every 72 hours
 - B. PRN change - site dressing to be changed immediately if soiled, wet, or nonocclusive
 - C. Aseptic technique must be adhered to during dressing change.
 - D. The site should be assessed for signs of developing local complication at time of each dressing change.
- VI. Replacement of Peripheral Cannula
 - A. Reason
 - 1. Presence of infiltration
 - 2. Presence of phlebitis
 - 3. Occlusion of cannula
 - 4. To avoid exceeding time span restrictions
 - a. Every 48 to 72 hours
 - b. EXCEPTION: time may need to be modified if limited venous accessibility with documentation as to the reason for noncompliance with CDC recommendation and supportive documentation of trouble-free site
 - B. Labeling - site should be labeled at time of change
 - 1. Gauge, type, and length of cannula
 - 2. Date and time
 - 3. Initials/name
- VII. Changing Entire Intravenous System - the entire IV system, including the cannula, should be changed if purulent thrombophlebitis, cellulitis, or IV-related bacteremia are suspected

VIII. Maintaining Heparin Lock Patency

(II-6)

- A. Reason - to prevent occlusion of a heparin lock thereby providing a patent cannula for intermittent vascular access
- B. Process
 - 1. Flushing of heparin lock with N/S before and after drug delivery to prevent incompatibilities.
 - 2. Instillation of heparinized saline solution to prevent clot formation

IX. Monitoring

- A. Observe status of IV frequently.
 - 1. Rate of flow
 - 2. Amount of solution remaining
 - 3. Site
- B. When alteration in flow occurs, cause should be identified and appropriate intervention initiated.

X. Summary and Conclusion

- A. Maintenance of flow rate
- B. Calculation of flow rates
- C. Changing fluid containers
- D. Changing administration set tubing/components
- E. Changing IV site dressings
- F. Replacement of peripheral cannula
- G. Changing entire intravenous system
- H. Maintaining heparin lock patency
- I. Monitoring

LESSON PLAN: I

COURSE TITLE: INTRAVENOUS FLUID THERAPY

UNIT VII INTRAVENOUS FLUID THERAPY MAINTENANCE

INTERACTION ITEMS:

1. Why should the nurse be aware of intravenous infusion flow rates?
2. Why is it necessary to be able to calculate IV flow rates?
3. Why should you change fluid containers?
4. When should you change IV tubing?
5. Why should you perform IV site care?
6. Is it necessary to assure heparin lock patency?

CLASSROOM, LABORATORY, OR OTHER ACTIVITIES:

- I. Calculate IV flow rates by completing AS I.

LESSON PLAN: 1

COURSE TITLE: INTRAVENOUS FLUID THERAPY

UNIT VII INTRAVENOUS FLUID THERAPY MAINTENANCE

EVALUATION ITEMS:

I. List five hazards related to inaccurate infusion rates.

a.

b.

c.

d.

e.

For each of the following, write "T" if the statement is true, or "F" if it is false.

- ☐ 2. Refrigerated solutions prevent venous spasms.
- ☐ 3. Raising the level of IV containers increases the flow rate.
- ☐ 4. Flow rates may vary based on the patient's position.
- ☐ 5. Pushing the bevel of the needle against the wall of the vein does not alter the flow of the IV.
- ☐ 6. Tubing should be changed every 24-48 hours according to the guidelines from the Centers for Disease Control.
- ☐ 7. Warm refrigerated fluids by submerging in hot water before administering.
- ☐ 8. The fluid container is usually placed 30-36 inches above the patient.
- ☐ 9. Pharmacological properties of the infusate have no effect on the ordered rate of administration.
- ☐ 10. Tubing dangling below the bed will not alter the flow rate.
- ☐ 11. An unexpected interruption causing an unusually long delay while changing fluid containers will not affect the cannula flow rate.
- ☐ 12. Parenteral fluids should be discarded if not infused within 24 hours.
- ☐ 13. Lipid emulsion should be discarded if not infused within 24 hours.
- ☐ 14. IVPB administration sets do not have to be changed as frequently as the primary sets.

- ___ 15. The lipid emulsion infusion set is for one time use only.
- ___ 16. Blood and blood component sets should be changed every 24 hours.
- ___ 17. Recommended routine changes of IV site dressings is every 8 hours.
- ___ 18. The site should be assessed for signs of developing local complications at the time of each dressing change.
- ___ 19. If the patient is exhibiting symptoms of phlebitis at the IV site but has limited venous accessibility and the infusate is flowing at the prescribed rate, it is permissible to leave the cannula in the present site with documentation as for the reason for doing so.
- ___ 20. Peripheral cannulas should be changed every 24-48 hours.
- ___ 21. N/S is instilled into a heparin lock to prevent clot formation.
- ___ 22. Monitoring of IV's should include the rate of flow, amount of solution remaining, and site.
- ___ 23. If an alteration in flow rate is discovered, the nurse should identify the cause and intervene appropriately.
- ___ 24. If you are certain the heparin lock is patent, it is not necessary to flush with N/S before and/or after drug delivery.

Use appropriate formulas for calculating flow rates for the following:

25. Calculate ml/hr. Patient is to receive 1800 cc of solution in 24 hours.

26. Convert 75 ml/hr to gtts/min (using 10 gtts/cc set).

LESSON PLAN: I
COURSE TITLE: INTRAVENOUS FLUID THERAPY
UNIT VII INTRAVENOUS FLUID THERAPY MAINTENANCE

ANSWERS TO EVALUATION ITEMS:

1. The student may list any five of the following:
 - a. Drug toxicity
 - b. Delayed responses to drugs
 - c. Pulmonary edema
 - d. Metabolic disturbances
 - e. Heightened potential for nervous irritation and phlebitis
 - f. Air embolism from dry containers
 - g. Occluded cannula due to cessation of flow rate
2. F
3. T
4. T
5. F
6. T
7. F
8. T
9. F
10. F
11. F
12. T
13. F
14. F
15. T
16. F
17. F
18. T
19. F
20. F
21. F
22. T
23. T
24. F
25. $1800 \text{ cc} \times \frac{24 \text{ hr}}{60} = 720 \text{ ml/hr}$
26. $\frac{75 \text{ ml/hr} \times 10 \text{ gtts/ml}}{60} = 12.5 \text{ gtts/min}$ or $\frac{75 \text{ cc}}{6} = 12.5 \text{ gtts/min}$

Factors that Alter Flow Rate

1. The Height of the Parenteral Solution Container
2. A Change in the Position of the Venipuncture Device
3. A Change in the Patient's Position
4. A Change in the Temperature of the Parenteral Solution
5. Partial Occlusion of the Venipuncture Device
6. Occluded Air Vent of a Vented Glass Container or a Vented Administration Set
7. Occluded In-Line Filter
8. Improperly Placed Wrist Restraints
9. Viscosity of the Infusing Parenteral Solution
10. Crimped Administration Set Tubing
11. Administration Set Tubing Dangling Below the Bed
12. Flexion of the Involved Extremity (Dependent upon the location of the venipuncture site and non-utilization of an armboard)
13. Venous Spasm
14. Undetected Infiltration of IV Infusion
15. Vein Trauma, i.e., Phlebitis, Thrombosis, etc.
16. Low Battery of an Electronic Device
17. Manipulative Patient and/or Visitor

Calculating Flow Rates

1. How much solution did the physician order?
2. Over how much time is this amount to infuse?
3. Divide amount of solution to be given by the delivery time.

Example: $\frac{1000 \text{ ml}}{8 \text{ hr}} = 125 \text{ ml/hr}$

4. Decide which type of drip system you are using.

(NOTE: The drop rate per milliliter of fluid varies with each manufacturer of macrodrip tubing. Abbott tubing delivers 15 gtt/ml; Travenol tubing delivers 10 gtt/ml; all microdrip tubings deliver 60 gtt/ml.)

5. Calculate drops per minute to deliver set amount of fluid per hour.

$$\frac{\text{gtt/ml}}{60 \text{ sec/min}} \times \frac{\text{Amt Fluid/hr}}{1} = \text{gtt/min}$$

Example:

$$\frac{10}{60} \times \frac{125}{1} = \frac{1250}{60} = 21 \text{ gtt/min}$$

or:

With sets that deliver 10 gtts/ml, divide hourly volume by 6.

Example:

$$\frac{125 \text{ ml/hr}}{6} = 21 \text{ gtts/min}$$

With sets that deliver 15 gtts/ml, divide hourly volume by 4.

Example:

$$\frac{125 \text{ ml/hr}}{4} = 31 \text{ gtts/min}$$

ASSIGNMENT SHEET I: CALCULATIONS OF IV FLUID FLOW RATES

DIRECTIONS: Calculate the following:

1. Calculate the correct flow rate in ml/hr for a patient who is to receive 1,800 ml of solution in 24 hours.

2. Determine gtts/min for a patient who is to receive 1,000 ml of solution in 10 hours.
 - a. With a set that delivers 15 gtts/ml

 - b. With a set that delivers 10 gtts/ml

 - c. With a set that delivers 60 gtts/ml

3. Determine gtts/min using a 15 gtts/ml set for a patient who is to receive 1,000 ml in 6 hours.

LESSON PLAN: I

COURSE TITLE: INTRAVENOUS FLUID THERAPY

UNIT VII INTRAVENOUS FLUID THERAPY MAINTENANCE

ANSWERS TO ASSIGNMENT SHEET I: CALCULATIONS OF IV FLUID FLOW RATES

1. $1,800 \text{ cc} \div 24 = 75 \text{ ml/hr}$

2. Method 1: $\frac{\text{vol. of fluid in ml}}{\text{time to be infused in minutes}} \times \text{calibration gtts/ml}$

a. $\frac{1,000 \text{ ml}}{600 \text{ min}} \times 15 \text{ gtts/ml} = \text{flow rate of } 25 \text{ gtts/min}$

b. $\frac{1,000 \text{ ml}}{600 \text{ min}} \times 10 \text{ gtts/ml} = 16\text{-}17 \text{ gtts/min}$

c. $\frac{1,000 \text{ ml}}{600 \text{ min}} \times 60 \text{ gtts/ml} = 100 \text{ gtts/min}$

Method 2: $\frac{\text{ml/hr}}{4 \text{ (15 gtts/ml set)}}$
or
 $6 \text{ (10 gtts/ml set)}$
or
 $1 \text{ (60 gtts/ml set)}$

a. For a set that delivers 15 gtts/ml
 $100 \text{ ml/hr} \div 4 = 25 \text{ gtts/min}$

b. For a set that delivers 10 gtts/ml
 $100 \text{ ml/hr} \div 6 = 16\text{-}17 \text{ gtts/min}$

c. For a set that delivers 60 gtts/ml
 $100 \text{ ml/hr} \div 1 = 100 \text{ gtts/min}$
(with sets that deliver 60 gtts/ml, ml/hr = gtts/min)

3. $\frac{1,000 \text{ ml}}{6 \text{ hr}} = 166 \text{ ml/hr}$

$\frac{166}{4} = 41\text{-}42 \text{ gtts/min}$

LESSON PLAN: 2

COURSE TITLE: INTRAVENOUS FLUID THERAPY

UNIT VII INTRAVENOUS FLUID THERAPY MAINTENANCE

SCOPE OF UNIT:

This unit introduces the principles of maintaining and calculating intravenous flow rates and maintaining administration set components, including cannulas. Also included are: provision of safety measures; changing site dressings; maintaining heparin lock patency; and discontinuing intravenous therapy.

INFORMATION TOPIC: OR DEMONSTRATION: X

CHANGING INTRAVENOUS FLUID CONTAINER
(Lesson Title)

LESSON OBJECTIVE - THE STUDENT WILL BE ABLE TO:

1. Change intravenous fluid container according to the steps of procedure without breaking sterility.

SUPPLEMENTARY TEACHING/LEARNING ITEMS:

1. Types of intravenous fluid containers
2. Types of intravenous administration sets

INFORMATIONAL ASSIGNMENT:

Plumer, Ada Lawrence. Principles and Practice of Intravenous Therapy. 4th ed. Boston: Little, Brown & Co., 1987, chs. 11, 12, 17.

REFERENCES:

Plumer, Ada Lawrence. Principles and Practice of Intravenous Therapy. 4th ed. Boston: Little, Brown & Co., 1987, chs. 11, 12, 17.

INTRODUCTION:

When adding sequential IV containers, or if time recommendations for hanging fluids have been met, changing IV fluid containers should be performed aseptically, safely and with knowledge of solutions and techniques.

LESSON PLAN: 2
COURSE TITLE: INTRAVENOUS FLUID THERAPY
UNIT VII INTRAVENOUS FLUID THERAPY MAINTENANCE

STEPS OF PROCEDURE:

- I. Plastic Bag and Plastic Bottle (II-1)
- A. Wash hands.
 - B. Verify fluid order, correct patient, and correct amount.
 - C. Remove outer plastic covering if present/check expiration date.
 - D. Check for particulate material, cloudiness, and leaks.
 - E. Ascertain that med port is securely covered.
 - F. Secure time strip to container.
 - G. Ascertain that cover over insertion port is secure.
 - H. Carefully remove insertion port covering with one swift motion.
 - I. Close tubing with roller clamp. Check for presence of air in tubing/drip chamber.
 - J. Aseptically remove set from old container and insert into new container.
 - K. Invert container.
 - L. Open clamp and adjust to desired rate.
 - M. Document.
- II. Closed or Open System (Glass Containers)
- A. Wash hands.
 - B. Verify fluid order, correct patient, and correct amount.
 - C. Check for patency of container; hold up to light and look for cracks.
 - D. Check for particulate matter in fluid.
 - E. Make sure rubber seal on top of bottle is depressed, ensuring sterile vacuum.
 - F. Check to be sure air port is secure.

- G. Secure time strip to bottle.
 - H. Remove rubber seal with one smooth upward pull motion.
 - I. Close tubing with roller clamp. Check for presence of air in tubing/drip chamber.
 - J. Aseptically remove set from old container and insert into new container.
 - K. Invert container.
 - L. Open clamp and adjust to desired rate.
 - M. Document.
- II. Summary and Conclusion
- A. Ask interaction item.
 - B. Review steps of procedure.

LESSON PLAN: 2
COURSE TITLE: INTRAVENOUS FLUID THERAPY
UNIT VII INTRAVENOUS FLUID THERAPY MAINTENANCE

INTERACTION ITEMS:

1. Why should nurses be aware of the different kinds of IV containers and procedures for use?

CLASSROOM, LABORATORY, OR OTHER ACTIVITIES:

1. Practice changing intravenous fluid containers using sterile technique.

LESSON PLAN: 2

COURSE TITLE: INTRAVENOUS FLUID THERAPY

UNIT VII INTRAVENOUS FLUID THERAPY MAINTENANCE

EVALUATION ITEMS: NAME OF STUDENT: _____

CHANGING INTRAVENOUS CONTAINER

EQUIPMENT:

1. Types of intravenous fluid containers
2. Types of intravenous administration sets

DID THE STUDENT:	YES	NO
<u>Plastic Bag/Plastic Bottle</u>		
1. Wash hands.		
2. Verify fluid order, correct patient, correct amount.		
3. Remove outer plastic covering if present/check expiration date.		
4. Check for particulate matter, cloudiness, leaks.		
5. Ascertain that med port is securely covered.		
6. Secure time strip to container.		
7. Ascertain that cover over insertion port is secure.		
8. Carefully remove insertion port covering with one swift motion.		
9. Close tubing with roller clamp; check for presence of air in tubing/drip chamber.		
10. Aseptically remove set from old container and insert into new container.		
11. Invert container.		
12. Open clamp and adjust to desired rate.		
13. Document.		

DID THE STUDENT:	YES	NO
<u>Closed or Open System (Glass Containers)</u>		
1. Wash hands.		
2. Verify fluid order, correct patient, correct amount.		
3. Check for patency of container; hold up to light and look for cracks.		
4. Check for particulate matter in fluid.		
5. Make sure rubber seal on top of bottle is depressed, ensuring sterile vacuum.		
6. Check to be sure air port is secure.		
7. Secure time strip to bottle		
8. Remove rubber seal with one smooth upward pull motion.		
9. Close tubing with roller clamp; check for presence of air in tubing/drip chamber.		
10. Aseptically remove set from old container and insert into new container.		
11. Invert container.		
12. Open clamp and adjust to desired rate.		
13. Document.		

The student has satisfactorily completed the procedure "CHANGING INTRAVENOUS FLUID CONTAINERS" according to the steps outlined.

Instructor's/Charge Personnel's Signature
(Verifying Satisfactory Completion)

Date

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LESSON PLAN: 3

COURSE TITLE: INTRAVENOUS FLUID THERAPY

UNIT VII INTRAVENOUS FLUID THERAPY MAINTENANCE

SCOPE OF UNIT:

This unit introduces the principles of maintaining and calculating intravenous flow rates and maintaining administration set components, including cannulas. Also included are: provision of safety measures; changing site dressings; maintaining heparin lock patency; and discontinuing intravenous therapy.

INFORMATION TOPIC: OR DEMONSTRATION: X

CHANGING ADMINISTRATION SET TUBING
(Lesson Title)

LESSON OBJECTIVE - THE STUDENT WILL BE ABLE TO:

1. Change administration set tubing according to the steps of procedure.

SUPPLEMENTARY TEACHING/LEARNING ITEMS:

1. Anatomical model with cannula, connected to primary administration set and container of primary IV solution
2. Container of new IV fluid
3. New administration set tubing
4. Sterile 2 x 2 or alcohol sponge
5. Tape
6. Protective gloves
7. Tubing change label

INFORMATIONAL ASSIGNMENT:

Plumer, Ada Lawrence. Principles and Practice of Intravenous Therapy. 4th ed. Boston: Little, Brown & Co., 1987.

REFERENCES:

Plumer, Ada Lawrence. Principles and Practice of Intravenous Therapy. 4th ed. Boston: Little, Brown & Co., 1987.

INTRODUCTION:

It is a recommended practice to change the IV tubing when a new container of solution is hung. This procedure should be performed aseptically, quickly and efficiently.

LESSON PLAN: 3
COURSE TITLE: INTRAVENOUS FLUID THERAPY
UNIT VII INTRAVENOUS FLUID THERAPY MAINTENANCE

STEPS OF PROCEDURE:

I. Procedure for Changing Administration Set Tubing

- A. Wash hands.
- B. Prepare new container of primary IV solution and new IV administration set (as outlined in Unit VI, Lesson 3 Preparation for the Establishment of the Intravenous Line).
- C. Suspend from patient's IV standard.
- D. Prepare two pieces of tape, approximately three inches and five inches long.
- E. Remove tape from old tubing.

NOTE: Leave tape anchoring cannula in place!

- F. Put on protective gloves.
- G. Place sterile 2 x 2 or alcohol sponge under cannula/tubing connection.
- H. Close control clamp on old tubing.
- I. Holding new tubing between index and second fingers of dominant hand, remove protective cover from end.
- J. Use thumb and first finger of dominant hand to remove old tubing from hub of cannula, stabilizing cannula with nondominant hand.

NOTE: Bleeding can be minimized by compressing vein above tip of catheter with little finger.

- K. Quickly insert new tubing into cannula.
- L. Remove 2 x 2 or alcohol sponge.
- M. Secure tubing with tape.
- N. Open flow control clamp of new administration set and regulate to ordered flow rate.
- O. Add appropriately inscribed tubing change label.
- P. Document.

II. Summary and Conclusion

- A. Ask interaction items.
- B. Review steps of procedure.

LESSON PLAN: 3

COURSE TITLE: INTRAVENOUS FLUID THERAPY

UNIT VII INTRAVENOUS FLUID THERAPY MAINTENANCE

INTERACTION ITEMS:

1. Why is it recommended that administration set tubing be changed when new containers of solution are being hung?
2. What is the purpose in placing a sterile 2 x 2 or alcohol sponge under the cannula/tubing connection while changing tubing?

CLASSROOM, LABORATORY, OR OTHER ACTIVITIES:

1. Practice procedure with appropriate equipment.

LESSON PLAN: 3

COURSE TITLE: INTRAVENOUS FLUID THERAPY

UNIT VII INTRAVENOUS FLUID THERAPY MAINTENANCE

EVALUATION ITEMS: NAME OF STUDENT: _____

CHANGING ADMINISTRATION SET TUBING

EQUIPMENT:

1. Anatomical model with cannula connected to primary administration set and container of primary IV solution
2. Container of new IV fluid
3. New administration set tubing and tubing change label
4. Sterile 2 x 2 or alcohol sponge
5. Tape
6. Protective gloves

DID THE STUDENT:	YES	NO
1. Wash hands.		
2. Prepare new container of primary solution and new IV administration set tubing.		
3. Suspend from patient's IV standard.		
4. Prepare tape.		
5. Remove tape from old tubing without disturbing cannula/cannula tape.		
6. Put on protective gloves.		
7. Place sterile 2 x 2 or alcohol sponge under cannula/tubing connection.		
8. Close control clamp on old tubing.		
9. Remove protective covering from new tubing.		
10. Remove old tubing from cannula hub while stabilizing cannula.		
11. Quickly insert new tubing into cannula.		
12. Remove 2 x 2 or alcohol sponge.		

DID THE STUDENT:	YES	NO
13. Secure tubing with tape.		
14. Open flow control clamp of new administration set and regulate to ordered flow rate.		
15. Place tubing change label on tubing		
16. Remove gloves.		
17. Document.		

The student has satisfactorily completed the procedure "CHANGING ADMINISTRATION SET TUBING" according to the steps outlined.

Instructor's/Charge Personnel's Signature
(Verifying Satisfactory Completion)

Date

LESSON PLAN: 4

COURSE TITLE: INTRAVENOUS FLUID THERAPY

UNIT VII INTRAVENOUS FLUID THERAPY MAINTENANCE

SCOPE OF UNIT:

This unit introduces the principles of maintaining and calculating intravenous flow rates and maintaining administration set components, including cannulas. Also included are: provision of safety measures; changing site dressings; maintaining heparin lock patency; and discontinuing intravenous therapy.

INFORMATION TOPIC: X

AND

DEMONSTRATION: X

USE OF ARMBOARDS AND RESTRAINTS
(Lesson Title)

LESSON OBJECTIVES - THE STUDENT WILL BE ABLE TO:

1. State the purpose of armboard/restraint application.
2. List four indications for use of armboard.
3. Identify principles of restraint application for the IV therapy patient.
4. Correctly apply an armboard according to the steps of procedure.

SUPPLEMENTARY TEACHING/LEARNING ITEMS:

1. HO 1: Applying an Armboard to Patient
2. Anatomical model
3. Armboard
4. Restraint
5. Tape

INFORMATIONAL ASSIGNMENT:

Nursing '80 Photobook Series, Managing IV Therapy. Horsham, PA: Intermed Communications, Inc., 1980, pp. 44-46.

Plumer, Ada Lawrence. Principles and Practice of Intravenous Therapy. 4th ed. Boston: Little, Brown & Co., 1987.

REFERENCES:

Nursing '80 Photobook Series, Managing IV Therapy. Horsham, PA: Intermed Communications, Inc., 1980, pp. 44-46.

Plumer, Ada Lawrence. Principles and Practice of Intravenous Therapy. 4th ed. Boston: Little, Brown & Co., 1987.

INTRODUCTION:

During the provision of IV therapy, it is sometimes necessary to provide safety factors to minimize the potential of harm or injury to the patient.

LESSON PLAN: 4

COURSE TITLE: INTRAVENOUS FLUID THERAPY

UNIT VII INTRAVENOUS FLUID THERAPY MAINTENANCE

OUTLINE: (Key Points)

- I. Purpose of Armboard/Restraint Application - to protect the patient from accidental injury or harm
- II. Indications for Use
 - A. Armboard
 1. When IV site is located in an area of flexion
 2. During provision of therapy to pediatric patients and/or confused or hyperactive patients
 3. To provide additional stability to patients with extremely fragile skin and/or veins
 4. When solution being infused contains a vesicant agent
 - B. Restraints - when limited range of motion is indicated to prevent accidental harm or injury to self or others (II-1)
- III. Legality of Application of Restraints - dependent on individual institutional policy, a written order for restraint application may be required

STEPS OF PROCEDURE:

IV. Procedures for Application of Armboard/Restraints

A. Armboards (HO 1)

1. Place extremity on armboard in a functional position.
 - a. To prevent contractures
 - b. To prevent unnecessary discomfort
 - c. To prevent injury to the nerves and muscles of the upper arm
2. Face, or back-strap the tape used to secure armboard.
 - a. To ensure free blood circulation
 - b. To ease eventual removal
3. Gauze may be used in lieu of tape to apply armboard, however, this creates a barrier for easy observation of site.
4. To apply:
 - a. Place extremity on armboard.
 - b. Place tape around arm and armboard.
 - (1) Keep faced part of tape against patient's arm and adhesive part against armboard.
 - (2) Tape securely enough to immobilize the arm but loose enough to prevent impeding circulation.
 - (3) Do not completely encircle extremity with tape - may impede circulation.
 - c. Ascertain that circulation is not compromised.

B. Restraints

1. Avoid placing restraint directly over IV site.
2. Do not apply so tight as to impede circulatory flow.
3. Do not tie restraint to siderail.
4. Some armboards facilitate restraint application via strategically placed loops/slots.
5. To apply: apply according to manufacturer's recommendations.

V. Summary and Conclusion

- A. Purpose of armboard/restraint application
- B. Indications for use
- C. Legality of application of restraints
- D. Ask interaction items.
- E. Review steps of procedure.

LESSON PLAN: 4

COURSE TITLE: INTRAVENOUS FLUID THERAPY

UNIT VII INTRAVENOUS FLUID THERAPY MAINTENANCE

INTERACTION ITEMS:

1. Why is it necessary to be familiar with the employing institutions' policy regarding the application of restraints?

CLASSROOM, LABORATORY, OR OTHER ACTIVITIES:

1. Students apply armboards to each other.
2. Review their respective institution's policy regarding restraint application.

LESSON PLAN: 4

COURSE TITLE: INTRAVENOUS FLUID THERAPY

UNIT VII INTRAVENOUS FLUID THERAPY MAINTENANCE

EVALUATION ITEMS:

1. State the purpose of armboard/restraint application.
2. List four indications for use of an armboard.
 - a.
 - b.
 - c.
 - d.

Write the letter of the correct answer in the blank.

 3. When applying restraints:

1. Avoid placing directly over IV site.
2. Do not apply so tight as to impede circulatory flow.
3. Tie securely to siderail.
 - a. All of the above
 - b. None of the above
 - c. 2 and 3
 - d. 1 and 2

LESSON PLAN: 4

COURSE TITLE: INTRAVENOUS FLUID THERAPY

UNIT VII INTRAVENOUS FLUID THERAPY MAINTENANCE

EVALUATION ITEMS: NAME OF STUDENT: _____

APPLICATION OF ARMBOARD/RESTRAINTS

EQUIPMENT:

1. Anatomical model
2. Armboard
3. Restraint
4. Tape

DID THE STUDENT:	YES	NO
<u>Armboard</u>		
1. Place extremity on armboard.		
2. Tape armboard to extremity using faced or back strapped tape.		
<u>Restraints</u>		
1. Apply according to manufacturer's recommendations.		

The student has satisfactorily completed the procedure "APPLICATION OF ARMBOARD/RESTRAINTS" according to the steps outlined.

Instructor's/Charge Personnel's Signature
(Verifying Satisfactory Completion)

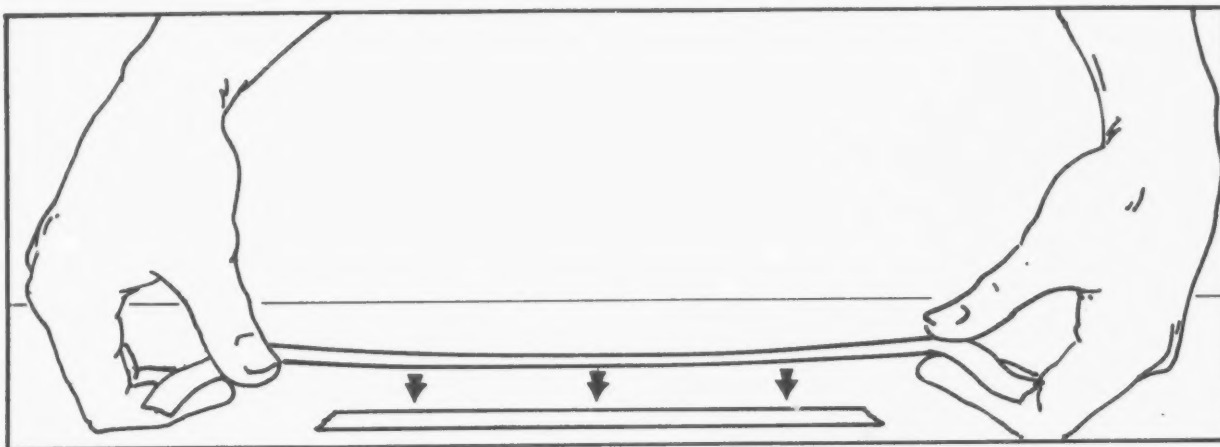
Date

LESSON PLAN: 4
COURSE TITLE: INTRAVENOUS FLUID THERAPY
UNIT VII INTRAVENOUS FLUID THERAPY MAINTENANCE

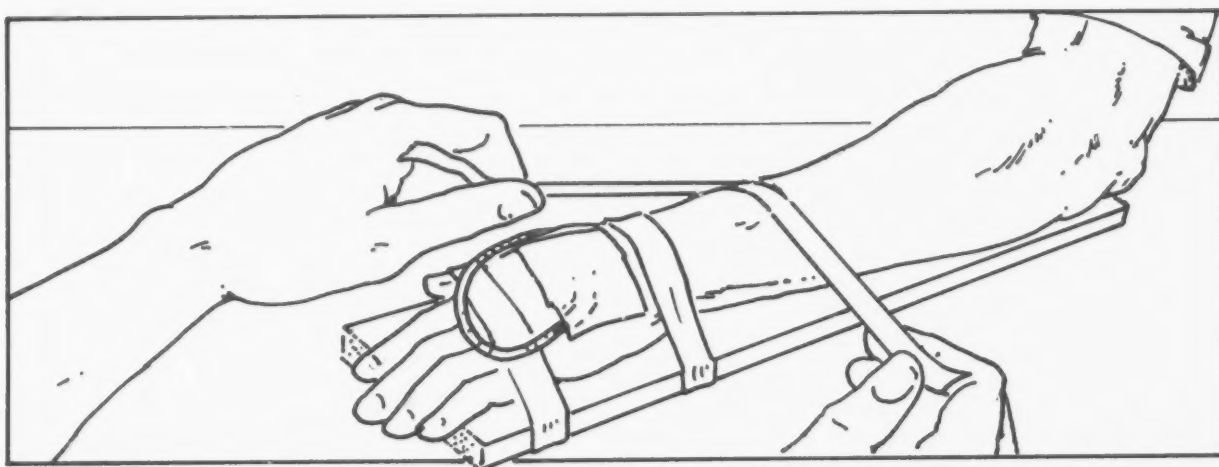
ANSWERS TO EVALUATION ITEMS:

1. To protect the patient from accidental injury or harm
2.
 - a. When IV site is located in an area of flexion
 - b. During provision of therapy to pediatric patients and/or confused or hyperactive patients
 - c. To provide additional stability to patients with extremely fragile skin and/or veins
 - d. When solution infusing contains a vesicant agent
3. d

Applying an Armboard to Patient



Backing Two Adhesive Strips Together



Place the non-adhesive sides in contact with the patient's arm. Allow the adhesive ends to go down and under to adhere to the underneath portion of the armband.

LESSON PLAN: 5

COURSE TITLE: INTRAVENOUS FLUID THERAPY

UNIT VII INTRAVENOUS FLUID THERAPY MAINTENANCE

SCOPE OF UNIT:

This unit introduces the principles of maintaining and calculating intravenous flow rates and maintaining administration set components, including cannulas. Also included are: provision of safety measures; changing site dressings; maintaining heparin lock patency; and discontinuing intravenous therapy.

INFORMATION TOPIC: X

AND

DEMONSTRATION: X

CARE OF INFUSION SITE
(Lesson Title)

LESSON OBJECTIVES - THE STUDENT WILL BE ABLE TO:

1. State the purpose of intravenous site dressing change.
2. State factors that determine the dressing change schedule.
3. List three observations of the site that would be indicative of developing complications.
4. Demonstrate care of infusion site according to the steps of procedure.

SUPPLEMENTARY TEACHING/LEARNING ITEMS:

1. Anatomical model with cannula and dressing in place
2. Isopropyl alcohol (70%) or povidone-iodine solution
3. Antimicrobial agent
4. Gauze dressing
5. Label
6. Transparent dressing
7. Tape
8. Protective gloves

INFORMATIONAL ASSIGNMENT:

Plumer, Ada Lawrence. Principles and Practice of Intravenous Therapy. 4th ed. Boston: Little, Brown and Co., 1987.

REFERENCES:

Sager, Diane Proctor and Suzanne Kovarovic Bomar. Intravenous Medications: A Guide to Preparation, Administration and Nursing Management. Philadelphia: J.B. Lippincott Co., 1980, ch. 4.

INTRODUCTION:

Changing the dressings at appropriate intervals gives the nurse an opportunity to observe the site for early signs or symptoms of complications as well as minimizing infection.

LESSON PLAN: 5

COURSE TITLE: INTRAVENOUS FLUID THERAPY

UNIT VII INTRAVENOUS FLUID THERAPY MAINTENANCE

OUTLINE: (Key Points)

- I. Purpose of IV Site Dressing Change - to observe the site for evidence of developing complications/infection
- II. Schedule (II-1)
 - A. Routine change-dependent upon type dressing used
 1. Gauze - every 24-48 hours
 2. Transparent - every 72 hours to 1 week
 - B. PRN - change should be done whenever the condition of a dressing becomes wet, soiled, or nonocclusive
- III. Observation/Evaluation of Site (II-2)
 - A. Absence of redness
 - B. Absence of swelling
 - C. Absence of induration
 - D. Absence of drainage
- IV. Principles
 - A. Aseptic technique must be observed.
 - B. The site should be cleansed with 70% isopropyl alcohol or povidone-iodine solution and allowed to dry.
 - C. An antimicrobial agent should be applied to injection site if mandated by institutional policy.
 - D. A label denoting date and time of change should be affixed to the new dressing.

STEPS OF PROCEDURE:

V. Procedure:

A. Gauze dressing

1. Wash hands.
2. Explain procedure to patient.
3. Put on protective gloves.
4. While stabilizing cannula, carefully remove tape and dressing from site.
5. Visually inspect site for evidence of developing complications.
6. Cleanse site with alcohol or povidone iodine solution and allow to dry.
7. Apply antimicrobial agent, if applicable.
8. Apply sterile dressing and secure with tape.
9. Remove gloves.
10. Reapply original label inscribed with insertion information to dressing, recopy if soiled or nonocclusive.
11. Apply tape label denoting dressing change information.
 - a. Date and time
 - b. Initials of person performing procedure

B. Transparent dressing

1. Wash hands.
2. Explain procedure to patient.
3. Put on protective gloves.
4. While stabilizing cannula, carefully remove existing transparent dressing.
5. Visually inspect site for evidence of developing complications.
6. Apply scant amount of antimicrobial agent to site, if applicable.
7. Apply sterile transparent dressing.
8. Remove gloves.

9. Recopy insertion data on new label and apply to dressing.
10. Apply small strip of tape denoting dressing change.
 - a. Date and time
 - b. Initials of person performing procedure

VI. Post-Dressing Change

- A. Remove contaminated dressing and rubbish from room and dispose of according to approved institutional policy.
- B. Charge for supplies used.
- C. Document procedure.

VII. Summary and Conclusion

- A. Purpose of IV site dressing change
- B. Schedule
- C. Observation/evaluation of site
- D. Principles
- E. Ask interaction items.
- F. Review steps of procedure.

LESSON PLAN: 5

COURSE TITLE: INTRAVENOUS FLUID THERAPY

UNIT VII INTRAVENOUS FLUID THERAPY MAINTENANCE

INTERACTION ITEMS:

1. Why aren't all types of dressings changed on the same schedule?
2. What site observations is the nurse responsible for?
3. Why should nurses document care?

CLASSROOM, LABORATORY, OR OTHER ACTIVITIES:

1. Practice changing gauze and transparent dressings.
2. Learn respective institutional policies and procedures relating to dressing changes.

LESSON PLAN: 5

COURSE TITLE: INTRAVENOUS FLUID THERAPY

UNIT VII INTRAVENOUS FLUID THERAPY MAINTENANCE

EVALUATION ITEMS:

1. State the purpose of intravenous site dressing change.
2. State two factors that determine the dressing change schedule.
 - a.
 - b.
3. List three observations of the site that would be indicative of developing complications.
 - a.
 - b.
 - c.

LESSON PLAN: 5

COURSE TITLE: INTRAVENOUS FLUID THERAPY

UNIT VII INTRAVENOUS FLUID THERAPY MAINTENANCE

EVALUATION ITEMS:

NAME OF STUDENT: _____

CARE OF INFUSION SITE

EQUIPMENT:

1. Anatomical model with cannula and dressing in place
2. Isopropyl alcohol (70%) or povidone-iodine solution
3. Antimicrobial agent
4. Gauze dressing
5. Label
6. Transparent dressing
7. Tape
8. Protective gloves

DID THE STUDENT:	YES	NO
<u>Gauze Dressing</u>		
1. Wash hands.		
2. Explain procedure to patient.		
3. Put on protective gloves.		
4. Stabilize cannula and remove tape and dressing from site.		
5. Visually inspect site for evidence of developing complications.		
6. Cleanse site with alcohol or povidone-iodine solution and allow to dry.		
7. Apply antimicrobial agent, if applicable.		
8. Apply sterile dressing and secure with tape.		
9. Remove gloves.		
10. Reapply original label inscribed with insertion information to dressing, recopy if soiled or nonocclusive.		
11. Apply tape label denoting dressing change information with date, time, and initials.		

DID THE STUDENT:	YES	NO
<u>Transparent Dressing</u>		
1. Wash hands.		
2. Explain procedure to patient.		
3. Put on protective gloves.		
4. Stabilize cannula and remove existing transparent dressing.		
5. Visually inspect site for evidence of developing complications.		
6. Apply scant amount of antimicrobial agent to site, if applicable.		
7. Apply sterile transparent dressing.		
8. Remove gloves.		
9. Recopy insertion data on new label and apply to dressing.		
10. Apply small strip of tape denoting dressing change information with date, time, and initials.		
<u>Post-Dressing Change</u>		
1. Remove contaminated dressing and rubbish from room and dispose of according to approved institutional policy.		
2. Charge for supplies used.		
3. Document procedure.		

The student has satisfactorily completed the procedure "CARE OF INFUSION SITE" according to the steps outlined.

Instructor's/Charge Personnel's Signature
(Verifying Satisfactory Completion)

Date

LESSON PLAN: 5

COURSE TITLE: INTRAVENOUS FLUID THERAPY

UNIT VII INTRAVENOUS FLUID THERAPY MAINTENANCE

ANSWERS TO EVALUATION ITEMS:

1. To observe the site for evidence of developing complications/infection
2.
 - a. Type of dressing
 - b. Condition of dressing
3. The student may list any three of the following:
 - a. Redness
 - b. Swelling
 - c. Induration
 - d. Drainage

LESSON PLAN: 6
COURSE TITLE: INTRAVENOUS FLUID THERAPY
UNIT VII INTRAVENOUS FLUID THERAPY MAINTENANCE

SCOPE OF UNIT:

This unit introduces the principles of maintaining and calculating intravenous flow rates and maintaining administration set components, including cannulas. Also included are: provision of safety measures; changing site dressings; maintaining heparin lock patency; and discontinuing intravenous therapy.

INFORMATION TOPIC: X AND DEMONSTRATION: X

HEPARIN LOCK PATENCY
(Lesson Title)

LESSON OBJECTIVES - THE STUDENT WILL BE ABLE TO:

1. State the purpose of a heparin flush.
2. List two factors that determine a heparin flush schedule.
3. Demonstrate heparin flush procedure according to the steps of procedure.

SUPPLEMENTARY TEACHING/LEARNING ITEMS:

1. HO 1: Heparinization/Intermittent Infusion Sets
2. Anatomical model with pre-inserted heparin lock
3. Syringe with 1 ml normal saline
4. Syringe with 1 ml heparinized saline
5. Alcohol sponges
6. Puncture-proof container

INFORMATIONAL ASSIGNMENT:

Plumer, Ada Lawrence. Principles and Practice of Intravenous Therapy. 4th ed. Boston: Little, Brown & Co., 1987.

REFERENCES:

Plumer, Ada Lawrence. Principles and Practice of Intravenous Therapy. 4th ed. Boston: Little, Brown & Co., 1987.

INTRODUCTION:

When using a heparin lock for intravenous therapy, patency of the cannula must be maintained. Achievement of this goal is realized by the aseptic flushing with normal saline and heparinized saline according to a schedule mandated by ordered therapy.

LESSON PLAN: 6

COURSE TITLE: INTRAVENOUS FLUID THERAPY

UNIT VII INTRAVENOUS FLUID THERAPY MAINTENANCE

OUTLINE: (Key Points)

- I. Purpose of the Heparin Flush - to prevent clotting therefore maintain patency of the cannula
- II. Schedule - dependent on: (HO I)
 - A. Ordered therapy
 - B. Type of cannula
- III. Principles
 - A. Absence of blood return is not always indicative of an occlusion; may be result of a small cannula or small vein.
 - B. Short needles should be used for injection purposes to avoid accidental contact and subsequent damage to plastic cannula. (II-1)

STEPS OF PROCEDURE:

IV. Flushing Procedure

- A. Wash hands.
- B. Explain procedure to patient.
- C. Verify injection cap securely attached to cannula.
- D. Cleanse injection cap with alcohol for one (1) minute.
- E. Using syringe containing normal saline, insert needle into center of injection cap and aspirate for blood return.
- F. Inject normal saline over one (1) minute.
- G. Using syringe containing heparinized saline, insert needle into center of injection cap.
- H. Inject heparinized saline over one (1) minute.
- I. Place used syringes and needles in puncture-proof container.
- J. Remove used and contaminated equipment from room and dispose of according to institutional policy.
- K. Charge for supplies used.
- L. Document procedure.

V. Summary and Conclusion

- A. Purpose of the heparin flush
- B. Schedule
- C. Principles
- D. Ask interaction items.
- E. Review steps of procedure.

LESSON PLAN: 6

COURSE TITLE: INTRAVENOUS FLUID THERAPY

UNIT VII INTRAVENOUS FLUID THERAPY MAINTENANCE

INTERACTION ITEMS:

1. Why should you use short needles in the injection cap?
2. Why should nurses check lock sites?
3. Why do you check for blood return before flushing with heparin?

CLASSROOM, LABORATORY, OR OTHER ACTIVITIES:

1. Practice doing heparin flush on anatomical model.

LESSON PLAN: 6

COURSE TITLE: INTRAVENOUS FLUID THERAPY

UNIT VII INTRAVENOUS FLUID THERAPY MAINTENANCE

EVALUATION ITEMS:

1. State the purpose of a heparin flush.
2. List two factors that determine a heparin flush schedule.
 - a.
 - b.

LESSON PLAN: 6

COURSE TITLE: INTRAVENOUS FLUID THERAPY

UNIT VII INTRAVENOUS FLUID THERAPY MAINTENANCE

EVALUATION ITEMS: NAME OF STUDENT: _____

HEPARIN FLUSH

EQUIPMENT:

1. Anatomical model with pre-inserted heparin lock
2. Syringe with 1 ml normal saline
3. Syringe with 1 ml heparinized saline
4. Alcohol sponges
5. Puncture-proof container

DID THE STUDENT:	YES	NO
1. Wash hands.		
2. Explain procedure to patient.		
3. Verify injection cap securely attached to cannula.		
4. Cleanse injection cap with alcohol for one (1) minute.		
5. Using syringe containing NS, insert needle into cap and aspirate for blood return.		
6. Inject NS over one (1) minute.		
7. Insert needle of heparinized saline into injection cap and inject over one (1) minute.		
8. Place syringes and needles in puncture-proof container.		
9. Remove used and contaminated equipment from area and dispose of.		
10. Charge for supplies used.		
11. Document procedure.		

The student has satisfactorily completed the procedure "HEPARIN FLUSH" according to the steps outlined.

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Instructor's/Charge Personnel's Signature
(Verifying Satisfactory Completion)

475

Date

LESSON PLAN: 6

COURSE TITLE: INTRAVENOUS FLUID THERAPY

UNIT VII INTRAVENOUS FLUID THERAPY MAINTENANCE

ANSWERS TO EVALUATION ITEMS:

1. To prevent clotting therefore maintain patency of the cannula
2.
 - a. Ordered therapy
 - b. Type of cannula

Heparinization/Intermittent Infusion Sets

TIME SCHEDULE

REASON FOR HEPARIN LOCK UTILIZATION	TIME SCHEDULE FOR HEPARINIZATION
1. To provide immediate intravascular access in the event that the patient's status should change	Immediately after insertion of the heparin lock and then every 8-24 hours dependent upon type of cannula
2. For a daily IV push injection or daily IVPB infusion of full strength heparin	Immediately following the administration of the ordered full strength heparin and then every 8-24 hours dependent upon type of cannula
3. For multiple IV push injections or IVPB infusions of full strength during a 24 hour period	Immediately following each IV push injection or IVPB infusion of full strength heparin
4. For a daily IV push injection or IVPB infusion of any medications OTHER THAN heparin	Immediately following the administration of the medication and subsequent flushing of the heparin lock with bacteriostatic sodium chloride and then every 8-12 hours
5. For multiple IV push injections or IVPB infusions of any medications OTHER THAN heparin during a 24 hour period	Immediately following each administration of medication and subsequent flushing of the heparin lock with bacteriostatic sodium chloride

LESSON PLAN: 7

COURSE TITLE: INTRAVENOUS FLUID THERAPY

UNIT VII INTRAVENOUS FLUID THERAPY MAINTENANCE

SCOPE OF UNIT:

This unit introduces the principles of maintaining and calculating intravenous flow rates and maintaining administration set components, including cannulas. Also included are: provision of safety measures; changing site dressings; maintaining heparin lock patency; and discontinuing intravenous therapy.

INFORMATION TOPIC: OR DEMONSTRATION: X

DISCONTINUANCE OF INTRAVENOUS INFUSION
(Lesson Title)

LESSON OBJECTIVE - THE STUDENT WILL BE ABLE TO:

1. Discontinue IV infusion according to the steps of procedure.

SUPPLEMENTARY TEACHING/LEARNING ITEMS:

1. IV-accessed anatomical model
2. Sterile sponges
3. Sterile dressing
4. Tape
5. Protective gloves

INFORMATIONAL ASSIGNMENT:

Plumer, Ada Lawrence. Principles and Practice of Intravenous Therapy. 4th ed.
Boston: Little, Brown & Co., 1987.

REFERENCES:

Plumer, Ada Lawrence. Principles and Practice of Intravenous Therapy. 4th ed.
Boston: Little, Brown & Co., 1987.

INTRODUCTION:

At the completion of IV fluid therapy, safe discontinuance is of extreme importance.
Care must be taken to assure sterility and to avoid injury to the lumen of the vein.

LESSON PLAN: 7

COURSE TITLE: INTRAVENOUS FLUID THERAPY

UNIT VII INTRAVENOUS FLUID THERAPY MAINTENANCE

STEPS OF PROCEDURE:

- I. Preparation for Discontinuance
 - A. Check order.
 - B. Wash hands.
 - C. Explain procedure to patient.
 - D. Close flow control clamp.
 - E. Put on protective gloves.
- II. Removal of cannula
 - A. While stabilizing cannula, carefully remove tape and dressing.
CAUTION: DO NOT USE SCISSORS!
 - B. Visually inspect site for evidence of local complications.
 - C. Place sterile sponge over site.
 - D. Quickly and smoothly remove cannula.
 - E. With extremity elevated, apply pressure instantly and firmly until all bleeding ceases.
 - F. Apply dressing to site.
 - G. Verify cannula was removed in entirety.
 - H. Remove gloves/wash hands.
- III. Patient Instructions
 - A. Leave dressing in place for 24 hours.
 - B. Avoid rubbing, scratching or bumping site.
 - C. Notify nurse if renewed bleeding or pain/discomfort should develop.

IV. Post-Discontinuance

- A. Dispose of used and contaminated equipment according to approved institutional policy.
- B. Charge for supplies used.
- C. Document procedure.

II. Summary and Conclusion

- A. Ask interaction items.
- B. Review steps of procedure.

LESSON PLAN: 7

COURSE TITLE: INTRAVENOUS FLUID THERAPY

UNIT VII INTRAVENOUS FLUID THERAPY MAINTENANCE

INTERACTION ITEMS:

- i. Why are scissors never used to remove tape and/or dressings?
2. What information must be clearly documented after removing an IV cannula?

CLASSROOM, LABORATORY, OR OTHER ACTIVITIES:

1. Practice discontinuing IV cannulas and applying a dressing using aseptic technique.
2. Appropriately document discontinuance of IV cannula.

LESSON PLAN: 7

COURSE TITLE: INTRAVENOUS FLUID THERAPY

UNIT VII INTRAVENOUS FLUID THERAPY MAINTENANCE

EVALUATION ITEMS: NAME OF STUDENT: _____

DISCONTINUANCE OF IV INFUSION

EQUIPMENT:

1. IV-accessed anatomical model
2. Sterile sponges
3. Sterile dressing
4. Tape
5. Protective gloves

DID THE STUDENT:	YES	NO
1. Prepare for discontinuance.		
a. Check order.		
b. Wash hands.		
c. Explain procedure to patient.		
d. Close control clamp.		
e. Put on protective gloves.		
2. Remove cannula.		
a. Stabilize cannula and remove tape and dressing.		
b. Visually inspect site for evidence of local complications.		
c. Place sterile sponge over site.		
d. Quickly and smoothly remove cannula.		
e. Elevate extremity and apply pressure to site.		
f. Apply dressing to site.		
g. Verify cannula was removed in entirety.		
h. Remove gloves/wash hands.		

DID THE STUDENT:	YES	NO
3. Instruct patient.		
a. Leave dressing 24 hours.		
b. Avoid rubbing, scratching or bumping site.		
c. Notify nurse if renewed bleeding or develops pain/discomfort should develop.		
4. Complete post-discontinuance procedures.		
a. Dispose of equipment properly.		
b. Charge for supplies used.		
c. Document procedure properly.		

The student has satisfactorily completed the procedure "DISCONTINUANCE OF IV INFUSION" according to the steps outlined.

Instructor's/Charge Personnel's Signature
(Verifying Satisfactory Completion)

Date

LESSON PLAN: I
COURSE TITLE: INTRAVENOUS FLUID THERAPY
UNIT VIII PHARMACOLOGICAL CONSIDERATIONS OF
INTRAVENOUS MEDICATION

SCOPE OF UNIT:

This unit provides the practitioner with information regarding the basic principles of drug action as well as specific considerations associated with the safe and efficient delivery of intravenous drugs, including cytotoxic agents, administered by available intravenous routes.

INFORMATION TOPIC: X OR DEMONSTRATION:

INTRODUCTION TO INTRAVENOUS DRUG ADMINISTRATION
(Lesson Title)

LESSON OBJECTIVES - THE STUDENT WILL BE ABLE TO:

1. State three major objectives of drug administration.
2. List four advantages of the IV route.
3. List three disadvantages of the IV route.
4. Name five factors affecting responses to drugs.
5. Match types of incompatibilities to correct descriptions.
6. List three ways to prevent incompatibilities.
7. Define the two primary types of drug interactions.
8. List five factors that affect drug/admixture stability.
9. State the five rights of accurate drug administration.
10. List three modes of intravenous administration.

SUPPLEMENTARY TEACHING/LEARNING ITEMS:

1. HO 1: Intravenous Drug Administration
2. HO 2: Intravenous Drug Incompatibilities
3. PDR (current edition)
4. Medical dictionaries
5. Intravenous Medications, A Handbook for Nurses and Other Allied Health Personnel. 4th ed. St. Louis: C.V. Mosby Company, 1985.

INFORMATIONAL ASSIGNMENT:

Plumer, Ada Lawrence. Principles and Practice of Intravenous Therapy. 4th ed. Boston: Little, Brown and Co., 1987.

Sager, Diane Proctor and Suzanne Kovarovic Bomar. Intravenous Medications: A Guide To Preparation, Administration and Nursing Management. Philadelphia: J.B. Lippincott Co., 1980.

REFERENCES:

Plumer, Ada Lawrence. Principles and Practice of Intravenous Therapy. 4th ed. Boston: Little, Brown and Co., 1987.

Sager, Diane Proctor and Suzanne Kovarovic Bomar. Intravenous Medications: A Guide To Preparation, Administration and Nursing Management. Philadelphia: J.B. Lippincott Co., 1980.

Gahart, Betty L. Intravenous Medications, A Handbook For Nurses and Other Allied Health Personnel. 4th ed. St. Louis: C.V. Mosby Company, 1985.

Tressel, Lawrence A., "Physiochemical Determinants of Incompatibility and Instability in Injectable Drug Solution and Admixtures." Handbook on Injectable Drugs. 3rd ed. Bethesda, MD: American Society of Hospital Pharmacists, 1983.

INTRODUCTION:

Today intravenous therapy is used extensively for drug administration. One must be aware, however, that apart from complications associated with the insertion and maintenance of the IV line, the actual intravenous administration of drugs is fraught with numerous potential hazards. To achieve the maximal therapeutic benefit with minimal hazards, the nurse must be familiar with the basic principles of drug action as well as specific considerations associated with each route of intravenous administration.

LESSON PLAN: I
COURSE TITLE: INTRAVENOUS FLUID THERAPY
UNIT VIII PHARMACOLOGICAL CONSIDERATIONS OF
INTRAVENOUS MEDICATION

OUTLINE: (Key Points)

I. Terms and Definitions

- A. Aminoglycosides - a specific group of antimicrobial agents that are used almost exclusively to treat infections caused by gram-negative bacteria
- B. Analgesic - a drug which relieves pain
- C. Anesthetic - a compound that reversibly depresses neuronal function, producing loss of ability to perceive pain and/or other sensations
- D. Antiarrhythmic - an agent that prevents or arrests irregular heart beat
- E. Antibiotics - chemical substances produced by certain bacteria that suppress growth of other bacteria and may eventually destroy them
- F. Anticoagulant - an agent that prevents coagulation (clotting) of the blood
- G. Anticonvulsant - an agent that prevents or arrests convulsions
- H. Antihypertensive - an agent that reduces the blood pressure of hypertensive subjects
- I. Antineoplastic - a drug that prevents the development, maturation, or spread of a neoplasm (abnormal growth, tumor)
- J. Barbituate - any derivative of barbituric acid that is used as a sedative
- K. Curative - having healing or remedial properties
- L. Diagnostic - of or relating to diagnosis
- M. Drug - medicinal agent that is intended to produce a desirable change in the body; used to treat, diagnose, or prevent disease
- N. Electrolytes - electrically-charged ions used to maintain acid-base balance of body
- O. Enzyme - a protein which acts as a catalyst by promoting or accelerating a chemical change in other substances while remaining unchanged in the process

- P. Experimental - in reference to a test or trial; investigational
- Q. Immunosuppressive - a drug that modifies the immune response, in a negative way, so it will have a diminished reaction to a foreign substance
- R. Incompatible - incapable of being mixed or used simultaneously without undergoing chemical changes or producing undesirable effects
- S. Injection - the administration of a relatively small volume of a concentrated solution of a drug directly into the venous system from a syringe via IV tubing, cannula, or the vein itself via needle; given over a short period of time, such as a bolus
- T. Intermittent infusion - dose of a drug is added to a small volume of fluid (50-100 cc) and the mixture is infused over a period of time ranging from 20 minutes to 2 hours; this technique of delivery produces peaks in the blood level of the drug (piggyback)
- U. Interaction - actions on or with each other
- V. Narcotic - a drug intended for the relief of pain which is capable of inducing a state of stuporous analgesia
- W. Oxytocic - a drug which stimulates uterine contractions
- X. Palliative - serving to relieve or alleviate, without curing
- Y. Precipitate - substance which settles as solid particles in solution
- Z. Prophylactic - warding off disease; drugs which ward off diseases
- AA. Systemic - of or affecting the body as a whole
- BB. Therapeutic - serving to cure or heal
- CC. Titrate - to change flow rate to achieve a desired effect
- DD. Vasopressor - an agent that causes constriction of the blood vessels and a rise in blood pressure

II. Objectives of Drug Administration

- A. Diagnostic purposes - to assess functions of certain organs or organ systems
 - 1. Conray for intravenous pyelogram
 - 2. Nuclear agents for bone imaging
 - 3. Thallium for thallium stress test
- B. Prophylactic purposes
 - 1. Pre-operative antibiotics

2. Lidocaine - to prevent ectopic beats postmyocardial infarction
- C. Therapeutic purposes
 1. Curative - example: antibiotic therapy
 2. Palliative - relief of symptoms as with analgesic administration
 3. Supportive - sustaining patient while other types of therapy are being employed; example - anesthesia during surgery
 4. Temporary alteration of normal processes; example - anticoagulant administration
 5. Replacement therapy - substituting substances which are normally in the body which may be depleted or absent in certain disease states; example - vitamins, insulin, electrolytes, etc.

III. Advantages of IV Route (HO 1) (II-1)

- A. Insures almost immediate and total absorption and rapid delivery to the site of action; circulation time is usually less than one (1) minute
 1. Pulmonary circulation time - approximately 12-15 seconds
 2. Systemic circulation time - approximately 17-23 seconds
- B. Precise dosage calculation and flow rates can be achieved.
- C. Should an adverse drug reaction (ADR) occur during administration, the remainder of the drug can be discontinued immediately.
- D. Pain and irritation to the tissues, which can accompany intramuscular (IM) or subcutaneous (S/C) administration, can be avoided.
- E. Provides an alternate route of delivery for drugs which are highly irritating to the gastrointestinal (GI) tract or which are inactivated by gastric secretions
- F. Provides a means of delivery for those patients whose clinical condition warrants being placed on NPO (nothing by mouth)
- G. The dose can be titrated to sustain continuous control of the therapeutic response.

IV. Disadvantages of IV Route (HO 1)

- A. There is no recall system; since untoward reactions can occur with the same rapidity as the desired response, unexpected effects can be serious and may be fatal
 1. Proper patient identification is essential.

2. The key is: "Prevention, Not Intervention"
 - B. There is added risk of IV therapy-related complications; aseptic technique is essential
 - C. IV therapy procedures require a considerable degree of knowledge and skill which limits the group of available personnel qualified to perform such procedures.
 - D. Even when administered skillfully, IV drug administration is not without some discomfort which can become a source of emotional trauma.
 - E. Existent drug incompatibilities
- V. Factors Affecting Response to Drugs (II-2)
- A. Size of individual
 1. Final concentration of a drug in the body is dependent on body mass; a drug dose which is within the therapeutic range for the "average" 70 kilogram (150 pound) adult may be ineffective for an obese person.
 2. Weight alone is not reflective of body mass.
 3. Body surface area is a major consideration in drug dosing. Nomograms are used for this purpose.
 - B. Age
 1. Children are more sensitive to drugs than are adults and require altered doses.
 2. Effects stage of development of organ systems
 3. Geriatric patients may require a smaller dose than young adults due to declining physiological functions associated with the aging process.
 - C. Sex
 1. Due to differences in body size and proportion, women are often more susceptible to the action of some drugs than are men.
 2. Great care must be undertaken in regard to drug dosing during pregnancy to avoid harming the fetus.
 - D. Genetic factors
 1. Inappropriate metabolism of a drug may be attributed to genetically-determined enzyme activity.
 2. Physician considers genetic factors associated with various ethnic and racial groups when determining drug dosage.

E. Presence of disease process

1. Alteration of drug dosage may be indicated when certain disease states are present. Hepatic and renal impairment interfere with normal metabolism and excretion of many drugs.
2. Presence of other pathological conditions may alter an individual's sensitivity to the effects of a particular drug.

F. Route of administration

1. Magnitude of response evoked by a drug will be limited by how much is absorbed into the circulatory system and distributed to appropriate sites of action.
2. Drugs given intravenous go directly into the circulation.
 - a. Higher serum level reached faster
 - b. Requires less dosage

G. Interaction with other drugs given concurrently

1. Dosage of drug given alone may produce a response within the therapeutic range
2. The addition of other drugs to the treatment regime can alter effects
 - a. Action can be intensified
 - b. Action can be reduced

VI. Incompatibilities (HO 2)

(II-3)

A. Types

1. Visual or physical incompatibility

- a. Precipitation
- b. Color change
- c. Evolution of gas
- d. Turbidity/cloudiness

NOTE: May be too sparse, transparent, fine, or palely colored to be readily detected visually

2. Chemical incompatibility

- a. Usually involves the irreversible degradation of drugs to produce therapeutically inactive or otherwise toxic products

- b. May or may not be visible
- c. Laboratory analysis may be only means of detection
- 3. Therapeutic incompatibility
 - a. An undesirable pharmacologic reaction occurring within a patient as a result of two or more drugs given concurrently
 - b. Effect may be potentiation or antagonism

B. Prevention of incompatibilities

- 1. Utilize current drug reference material prior to the administration of any drug intravenously.
- 2. Adhere to drug manufacturer's instructions regarding:
 - a. Reconstitution/preparation
 - b. Administration
- 3. Be aware that a warning to avoid mixing certain drugs "in any manner" means that the drugs cannot be combined under any circumstances in:
 - a. Syringe
 - b. Intravenous administration set tubing
 - c. Fluid container
- 4. Utilize special flushing techniques when incompatible drugs must be given through the same IV line.
- 5. Direct questions regarding incompatibilities to the professional pharmacy staff.

VII. Drug Interactions

A. Primary types

- 1. Antagonism - the inhibition of a drug's action by another drug
- 2. Synergism - an interaction in which the combined effect of the two drugs is greater than that of either one alone

B. Can occur when the drugs are given concurrently but separately

VIII. Factors Affecting Drug/Admixture Stability

A. Dose and concentration

- B. Number of additives
 - C. Order of adding drugs
 - D. Type of parenteral solution
 - E. Volume of parenteral solution
 - F. Complexation - two drugs given together may form a chemical complex and become inactivated
 - G. Time
 - H. Temperature
 - I. Exposure to light
- IX. Assurance of Accurate Drug Administration: Five (5) Rights of the Patient
- A. Right drug
 - B. Right dose
 - C. Right time
 - D. Right route
 - E. Right patient
- X. Modes of Intravenous Administration
- A. Continuous infusion
 - 1. Involves giving drug in primary container of fluid (250-1000 cc)
 - 2. Infusing it continuously over a period of several hours or days
 - B. Intermittent
 - 1. Given at one time or repeated at fixed, around-the-clock intervals
 - 2. Drug added to relatively small volumes of fluid (50-250 cc)
 - 3. Medication infused over 20 minutes to 2 hours
 - C. Direct
 - 1. Uses syringe and needle into IV line or vein
 - 2. Administered over seconds (bolus)
 - 3. Administered over timed minutes (IV push)

XI. Summary and Conclusion

- A. Terms and definitions
- B. Objectives of drug administration
- C. Advantages of IV route
- D. Disadvantages of IV route
- E. Factors affecting response to drugs
- F. Incompatibilities
- G. Drug interactions
- H. Factors affecting drugs/admixture stability
- I. Assurance of accurate drug administration: five (5) rights of the patient
- J. Modes of intravenous administration

LESSON PLAN: 1

COURSE TITLE: INTRAVENOUS FLUID THERAPY

UNIT VIII PHARMACOLOGICAL CONSIDERATIONS OF

INTRAVENOUS MEDICATION

INTERACTION ITEMS:

1. How can a major advantage of the IV route for drug administration also be a major disadvantage?
2. Why can't the same dose of medication be given IV to everyone?
3. Why is there concern for drug incompatibilities and interactions?

CLASSROOM, LABORATORY, OR OTHER ACTIVITIES:

1. Mix two visually or physically incompatible drugs to observe reaction.

LESSON PLAN: I

COURSE TITLE: INTRAVENOUS FLUID THERAPY

UNIT VIII PHARMACOLOGICAL CONSIDERATIONS OF

INTRAVENOUS MEDICATION

EVALUATION ITEMS:

1. State three major objectives of drug administration.

a.

b.

c.

2. List four advantages of the IV route.

a.

b.

c.

d.

3. List three disadvantages of the IV route.

a.

b.

c.

4. Name five factors affecting responses to drugs.

a.

b.

c.

d.

e.

For each of the following, match the incompatibility to the correct description by writing the appropriate letter in the blank.

- | | | |
|--------|--|-----------------------|
| ___ 5. | Usually involves irreversible degradation of drugs producing therapeutically inactive or toxic products | a. Visual or physical |
| | | b. Chemical |
| | | c. Therapeutic |
| ___ 6. | May note precipitation, change in color, gas, cloudiness | |
| ___ 7. | Undesirable pharmacological reaction occurring within a patient as a result of two or more drugs given concurrently; may be potentiation or antagonism | |
8. List three ways to prevent incompatibilities.
- a.
 - b.
 - c.
9. The inhibition of a drug's action by another drug is _____. (Fill in the blank.)
10. An interaction in which the combined effect of the two drugs is greater than that of either alone is _____. (Fill in the blank.)
11. List five factors that affect drug/admixture stability.
- a.
 - b.
 - c.
 - d.
 - e.
12. State the five rights of accurate drug administration.
- a.
 - b.
 - c.
 - d.
 - e.

13. List three modes of intravenous administration.

a.

b.

c.

LESSON PLAN: I
COURSE TITLE: INTRAVENOUS FLUID THERAPY
UNIT VIII PHARMACOLOGICAL CONSIDERATIONS OF
INTRAVENOUS MEDICATION

ANSWERS TO EVALUATION ITEMS:

1.
 - a. Diagnostic purposes
 - b. Prophylactic purposes
 - c. Therapeutic purposes
2. The student may list any four of the following:
 - a. Immediate absorption/rapid delivery
 - b. Precise dosage calculations
 - c. Can DC remainder immediately if adverse reaction occurs
 - d. Avoid tissue pain and irritation
 - e. Alternate route for drugs irritating to GI tract or incompatible with gastric secretions.
 - f. Route for NPO patients
 - g. Can be titrated for continuous control of therapeutic response
3. The student may list any three of the following:
 - a. No recall system
 - b. Added risk of IV complications
 - c. Limited available qualified personnel to administer
 - d. Some degree of discomfort - can become source emotional trauma
 - e. Existent drug incompatibilities
4. The student may list any five of the following:
 - a. Size
 - b. Age
 - c. Sex
 - d. Genetic factors
 - e. Presence of disease process
 - f. Route of administration
 - g. Interaction with other drugs given concurrently
5. b
6. a
7. c

8. The student may list any three of the following:
 - a. Utilize drug references.
 - b. Adhere to manufacturer's instructions for drugs.
 - c. Heed warning to avoid mixing "in any manner."
 - d. Utilize flushing techniques.
 - e. Direct questions to pharmacy.
9. Antagonism
10. Synergism
11. The student may list any five of the following:
 - a. Dose and concentration
 - b. Number of additives
 - c. Order of adding drugs
 - d. Type of parenteral solution
 - e. Volume of "parenteral solution"
 - f. Complexation
 - g. Time
 - h. Temperature
 - i. Exposure to light
12.
 - a. Right drug
 - b. Right dose
 - c. Right time
 - d. Right route
 - e. Right patient
13.
 - a. Continuous
 - b. Intermittent
 - c. Direct

Intravenous Drug Administration

Advantages of IV Route

1. Administration directly into a vein insures almost immediate and total absorption and rapid delivery to the site of action with therapeutic effects beginning almost immediately.
2. Because of total dose absorption, precise dosage calculation and flow rates can be achieved.
3. Should an adverse reaction to the drug occur during administration, the remainder of the drug can be immediately discontinued.
4. Prevention of pain and irritation to the tissues, which can accompany intramuscular and subcutaneous administration of many drugs
5. Provides an alternative route of delivery for drugs which are highly irritating to the gastrointestinal tract or are inactivated by gastric secretions
6. Provides a means of delivery for those patients whose clinical condition warrants being placed on NPO
7. The dose can be titrated to sustain continuous control of the therapeutic response.

Disadvantages of IV Route

1. There is no recall system for drugs administered intravenously.
2. There is the added risk of IV therapy-related complications, thrombosis, speedshock, etc.; and, unless aseptic technique is closely adhered to, infection.
3. IV therapy procedures require a considerable degree of skill, which limits the group of nurses and other health professionals qualified to perform such procedures. State legislation and institutional policy often impose further restrictions resulting in limited available personnel to administer drugs via the IV route.
4. Even when performed skillfully, intravenous cannula insertion and drug administration are not without some discomfort which can be a source of emotional trauma.
5. Existent drug incompatibilities

Intravenous Drug Incompatibilities

VISUAL/PHYSICAL INCOMPATIBILITY

Typified by precipitation, color change, evolution of gas, turbidity or cloudiness. NOTE: Some precipitates are transparent - too sparse, fine, or palely colored to be readily detected visually.¹

CHEMICAL INCOMPATIBILITY

Usually involves the irreversible degradation of drugs to produce therapeutically inactive or otherwise toxic products; it may or may not be visible, the only means of detection may be laboratory analysis.¹

THERAPEUTIC INCOMPATIBILITY

An undesirable pharmacological reaction occurring within a patient as a result of two or more drugs being given concurrently. The effect may be one of potentiation (increasing therapeutic response) or antagonism (negating the desired response). A therapeutic incompatibility may initially go undetected until it is noted that the patient has failed to show the expected clinical response to the drugs. In the event that an incompatibility is not suspected, the patient may be given increasingly higher doses of the drug to try to obtain the desired therapeutic effect. Should the incompatibility then be alleviated by the discontinuation of the other drug which caused it, an overdosage could result.²

Bibliography

1. Tressel, Lawrence A. "Physiochemical Determinants of Incompatibility and Instability in Injectable Drug Solution and Admixtures," *Handbook On Injectable Drugs*, 1980.
2. Sager, Diane P., Suzanne K. Bomar, and Joseph G. Barbaccia. *Intravenous Medications*, 1981.

LESSON PLAN: 2
COURSE TITLE: INTRAVENOUS FLUID THERAPY
UNIT VIII PHARMACOLOGICAL CONSIDERATIONS OF
INTRAVENOUS MEDICATION

SCOPE OF UNIT:

This unit provides the practitioner with information regarding the basic principles of drug action as well as specific considerations associated with the safe and efficient delivery of intravenous drugs, including cytotoxic agents, administered by available intravenous routes.

INFORMATION TOPIC: X OR DEMONSTRATION:

ADVERSE REACTIONS TO INTRAVENOUS DRUG ADMINISTRATION
(Lesson Title)

LESSON OBJECTIVES - THE STUDENT WILL BE ABLE TO:

1. Match types of drug reactions to correct descriptions.
2. Identify the signs and symptoms of the different types of reactions.
3. List five treatment elements generally instituted immediately to prevent death for Type I reactions.
4. Name four signs and symptoms of allergic reactions to observe for in the patient with no allergy history.

SUPPLEMENTARY TEACHING/LEARNING ITEMS:

1. HO 1: Untoward Drug Responses
2. HO 2: Signs and Symptoms of Anaphylactic Reaction
3. HO 3: Documentation of Anaphylactic Reaction
4. Copy of employing agency's policy and procedure regarding:
 - a. Anaphylactic shock
 - b. Communicating allergy history

INFORMATIONAL ASSIGNMENT:

Plumer, Ada Lawrence. Principles and Practice of Intravenous Therapy. 4th ed. Boston: Little, Brown and Co., 1987.

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Tressel, Lawrence A. Handbook on Injectable Drugs. 3rd ed. Bethesda, MD: American Society of Hospital Pharmacists, 1983.

INTRODUCTION:

It is essential that certain precautions be observed for all patients receiving intravenous drugs so that, in the event that an adverse drug response should occur, it will be immediately recognized and appropriate treatment instituted without delay.

LESSON PLAN: 2
COURSE TITLE: INTRAVENOUS FLUID THERAPY
UNIT VIII PHARMACOLOGICAL CONSIDERATIONS OF
INTRAVENOUS MEDICATION

OUTLINE: (Key Points)

- I. Adverse Drug Reactions (ADR's) (HO I)
 - A. Consist of wide variety of toxic drug reactions, dose or non-dose related, that occur in therapeutic situations
 - B. Usually excludes non-therapeutic overdosage; example - attempted suicide
 - C. Can occur even when great care has been undertaken in prescribing
 - D. Should be distinguished from side effects which, though therapeutically undesirable, are a consequence of the drug's normal action (II-I)
 - E. Can occur regardless of route of administration but are potentially more hazardous where drug is given intravenously due to immediacy of response
 - F. May be of a quantitative nature
 1. Tolerance - need for increasing amounts of a drug to produce the same therapeutic response; may develop after a drug has been given over a period of time
 2. Tachyphylaxis - rapidly developing tolerance to a drug occurring after only a very few doses have been given
 3. Cumulation - result of a drug having been given at a rate faster than it can be metabolized and excreted
 4. Intolerance - response greater than normal due to lowering of the threshold to normal pharmacological action
 - a. Referred to as hypersusceptibility
 - b. Requires that a lower than normal dose be given
 - G. May be of a qualitative nature
 1. Idiosyncrasy

- a. Generally refers to an unpredictable reaction or symptoms which are different in quality from the expected response and which are not due to an allergic reaction
- b. Evidence suggests that such reactions result from an enzyme deficiency interfering with the normal metabolism of the drug.
- c. Sometimes an individual response
- d. Believed to be a genetic deficiency of a familial or racial nature (II-2)

2. Toxicity

- a. Refers to the adverse effects which result directly from a pharmacological action of a drug
- b. Generally dose-related, occurring when the dose given exceeds the therapeutic level
- c. Can occur in some persons even though the drug was administered in the therapeutic dosage range
- d. Types
 - (1) Overdosage toxicity - predictable toxic effect that occurs with dosages in excess of the therapeutic range for a particular patient
 - (2) Absolute overdosage toxicity - results from an error in the amount or frequency of administration of individual doses

II. Drug Allergy (Hypersensitivity)

- A. Not most frequent adverse drug reaction
- B. Often responsible for most serious and fatal outcomes
- C. Is a response resulting from an antigen-antibody reaction or cell-mediated immunity
 - 1. Exposure to drug stimulates individual's immune system to form antibodies
 - 2. Once antibodies are present, individual is said to be sensitized
 - 3. On subsequent exposure to the drug an allergic response is evoked
- D. Types

I. Type I (anaphylactic or immediate)

- a. Reaction between antigen and antibodies that are bound to cells - releases histamine which acts on target organs and tissue
- b. Sudden, generalized systemic reaction occurring within seconds to minutes after exposure to a causative agent
- c. Signs and symptoms (HO 2)

- (1) Sense of uneasiness/anxiety
- (2) Diffuse erythema and feeling of warmth (with or without itching)
- (3) Hives on face and upper chest
- (4) Respiratory difficulty - choking sensation, swallowing difficulty, tightness or pain in chest, wheezing, shortness of breath, hoarseness
- (5) Angioedema

CAUTION: With massive facial angioedema, expect that upper respiratory edema may occur.

- (6) Severe abdominal cramps, nausea and vomiting
 - (7) Urinary and bowel incontinence
 - (8) Vascular collapse - cyanosis, pallor, imperceptible pulse
 - (9) Coma and death
- d. Treatment
- (1) Must be instituted immediately since death can ensue in a matter of minutes
 - (2) Essential elements generally include:
 - (a) Epinephrine to provide rapid relief of hypersensitivity reaction
 - (b) Establishment patent airway
 - (c) Establishment of a second, secure, patent IV line
 - (d) Administration of antihistamine drugs
 - (e) Administration of corticosteroids
 - (f) Administration volume expanders

- (g) Administration aminophylline
- (h) Close nursing observation, including vital sign monitoring, for at least 24 hours after the reaction or until stable

e. Documentation

- (1) Drug causing the reaction
 - (a) Name of drug
 - (b) Dose of drug administered
 - (c) Date and time of administration
 - (d) Route of administration
 - (e) Site of administration
- (2) Reaction
 - (a) Date and time
 - (b) Clinical signs and symptoms
 - (c) Duration of manifestation
- (3) Treatment
 - (a) Date and time
 - (b) Airway establishment
 - (c) Intravenous lines - sites and parenteral fluids
 - (d) Drugs
 - (e) Names of persons providing treatment
- (4) Patient's response to treatment
- (5) Follow-up monitoring
 - (a) Vital signs
 - (b) Observations
- (6) Health teaching
 - (a) Advisement of allergy
 - (b) Significance of allergy

(c) Availability of medical alert identification tags

2. Type II (cytotoxic or cytolytic)

- a. Antigen-antibody reaction occurs on cell surface resulting in cell destruction
- b. One responsible for hemolytic anemia of an allergic basis and other blood cell destruction
- c. May cause damage to individual organs
- d. Also called autoimmunity

3. Type III (arthrus type)

- a. Antigen-antibody complexes form microprecipitates and circulate in the serum
- b. Symptoms (either accelerated or late)
 - (1) Fever
 - (2) Urticaria
 - (3) Arthralgia
 - (4) Edema
 - (6) Neuritis

4. Type IV (delayed)

- a. A cell-mediated immunity due to lymphocytes which have been sensitized
- b. Contact dermatitis due to this type of mechanism

III. Ascertaining Allergy History

- A. At time of admittance patient should be questioned regarding allergy history.
- B. Patient admitting to a drug allergy should be questioned as to the type of allergic symptoms experienced.
- C. Questionable allergies should be communicated to the physician.
- D. Prior to IV drug administration patient should again be questioned concerning allergy history.

- IV. Communication of Allergy History to Allied Health Team Members
 - A. Must have a definitive policy regarding known allergy history of each patient
 - B. Communication of allergy history must be provided to all allied health team members
 - 1. Inscription on nursing care plan
 - 2. Eye-catching special warning tapes applied to front of patient's chart
 - 3. Use of special allergy-denoting patient wrist bracelets
 - 4. Admitting notes
 - 5. Input of data in computer system
- V. Drug-Produced Cross Reactions - may occur with related drugs; a person allergic to one drug has the potential for developing an allergic response to another related drug; example - penicillin and ampicillin
- VI. Nursing Implications - the nurse administering intravenous drugs is responsible for:
 - A. Identifying patients who are most susceptible to drug allergy
 - B. Instituting appropriate preventive measures
 - C. Observing for allergic reaction
 - D. Initiating/assisting in emergency treatment of an occurring allergic reaction
- VII. Monitoring Patient For Signs/Symptoms of Allergic Reactions
 - A. Patient with no allergy history
 - 1. Remain in close proximity during first 5-15 minutes after drug has started infusing.
 - 2. Observe for:
 - a. Hives
 - b. Nasal congestion
 - c. Anxiety
 - d. Shortness of breath
 - e. Wheezing

- f. Local reactions at the IV site
 - g. Angioneurotic edema - suddenly-occurring areas of painless edema usually on the face
- 3. In a manner that would not stimulate undue alarm, advise patient to report any of the above symptoms.
- 4. Monitor confused/comatose patients every 5-10 minutes until initial dose of drug has infused.
- 5. Check frequently during initial period of infusion of subsequent doses.
- B. Patients with an allergic history
 - 1. Remain in close proximity during first 10-20 minutes after drug has started infusing.
 - 2. Have immediate access to emergency medications.
 - 3. Continue to monitor patient every one-half hour for several hours post-initial infusion.
 - 4. Advise patient to immediately report occurrence of
 - a. Difficulty breathing
 - b. Wheezing
 - c. Any swelling
 - d. Any type of skin reaction
 - 5. Monitor during initial 5-10 minutes of infusion of subsequent doses.

VIII. Summary and Conclusion

- A. Adverse drug reactions (ADR's)
- B. Drug allergy (hypersensitivity)
- C. Ascertaining allergy history
- D. Communication of allergy history to allied health team members
- E. Drug-produced cross reactions
- F. Nursing implications
- G. Monitoring patient for signs/symptoms of allergic reaction

LESSON PLAN: 2

COURSE TITLE: INTRAVENOUS FLUID THERAPY

UNIT VIII PHARMACOLOGICAL CONSIDERATIONS OF
INTRAVENOUS MEDICATION

INTERACTION ITEMS:

1. What is the difference between an adverse drug reaction and a side effect?
2. How is a patient's genetic make-up related to ADR's?
3. Why is it important to be familiar with your employing institution's policies/procedures regarding anaphylactic shock and communicating allergy history?
4. How does documentation of anaphylactic shock differ from routine documentation?

CLASSROOM, LABORATORY, OR OTHER ACTIVITIES:

1. Practice documenting a mock anaphylactic reaction.

LESSON PLAN: 2

COURSE TITLE: INTRAVENOUS FLUID THERAPY

UNIT VIII PHARMACOLOGICAL CONSIDERATIONS OF
INTRAVENOUS MEDICATION

EVALUATION ITEMS:

Match the types of drug reactions to the correct descriptions.

- | | | | |
|---------|---|----|------------------------------------|
| ___ 1. | Adverse effects resulting directly from pharmacological action of a drug | a. | Adverse drug reaction (ADR) |
| ___ 2. | Need for increasing amounts of drug to produce the same therapeutic response | b. | Tolerance |
| ___ 3. | May occur with related drugs; person allergic to one drug has potential for allergy to a related drug - such as penicillin and ampicillin | c. | Tachyphylaxis |
| ___ 4. | Response greater than normal due to lowered threshold to normal pharmacological action | d. | Cumulation |
| ___ 5. | Reaction between antigen and antibodies bound to cells, releases histamines that act on organs and cells; sudden systemic reaction | e. | Intolerance |
| ___ 6. | Rapidly developing tolerance to drug after only few doses given | f. | Idiosyncrasy |
| ___ 7. | Cell-mediated immunity due to sensitized lymphocytes, i.e., contact dermatitis | g. | Toxicity |
| ___ 8. | Unpredictable reaction or response different in quality from the expected response | h. | Drug allergy (hypersensitivity) |
| ___ 9. | Antigen-antibody reaction occurs on cell surface with resulting cell destruction, i.e., hemolytic anemia | i. | Type I (anaphylactic or immediate) |
| ___ 10. | Wide variety of toxic drug reactions, dose or non-dose related, occurring in therapeutic situations | j. | Type II (cytotoxic or cytolytic) |
| ___ 11. | Antigen-antibody complexes form micro-precipitates and circulate in serum | k. | Type III (arthus) |
| | | l. | Type IV (delayed) |
| | | m. | Drug produced cross-reaction |

- ___12. Response resulting from antigen-antibody reaction or cell-mediated immunity-- often most serious and fatal outcomes
- ___13. Drug given at a faster rate than can be metabolized and excreted
14. Sense of uneasiness, feeling of warmth, hives on face and upper chest, respiratory difficulty, angioedema, severe abdominal cramps, urinary and bowel incontinence, vascular collapse, and coma are all signs and symptoms of _____. (Fill in the blank.)
15. List five treatment elements generally instituted immediately to prevent death for the above reaction.
- a.
 - b.
 - c.
 - d.
 - e.
16. Name four signs and symptoms of allergic reactions to observe for in the patient with no allergy history.
- a.
 - b.
 - c.
 - d.

LESSON PLAN: 2

COURSE TITLE: INTRAVENOUS FLUID THERAPY

UNIT VIII PHARMACOLOGICAL CONSIDERATIONS OF
INTRAVENOUS MEDICATION

ANSWERS TO EVALUATION ITEMS:

1. g
2. b
3. m
4. e
5. i
6. c
7. l
8. f
9. j
10. a
11. k
12. h
13. d
14. Type I or anaphylactic or immediate allergy reaction
15. The student may list any five of the following:
 - a. Epinephrine for rapid relief of hypersensitivity reaction
 - b. Establishment of patient airway
 - c. Establishment of second IV line
 - d. Administration of antihistamine drugs
 - e. Administration of corticosteroids
 - f. Administration of volume expanders
 - g. Administration of aminophylline
 - h. Close nursing observation including vital signs
16. The student may list any four of the following:
 - a. Hives
 - b. Nasal congestion
 - c. Anxiety
 - d. Shortness of breath
 - e. Wheezing
 - f. Local reactions at IV site
 - g. Angioneurotic edema

Untoward Drug Responses

Even when great care is taken to prescribe the dose of a drug or a particular drug, untoward effects, that is, effects which are unexpected and undesired can occur. These should be distinguished from *side effects*, which, though therapeutically undesirable, are a consequence of the drug's normal action.

Untoward drug responses are either QUANTITATIVE or QUALITATIVE.

Quantitative Drug Responses

- Tolerance
- Tachyphylaxis
- Cumulation
- Intolerance

Qualitative Drug Responses

- Idiosyncrasy
- Toxicity
- Drug Allergy

Types of Allergic Response

- Type I (Anaphylactic Type)
- Type II (Cytotoxic or Cytolytic)
- Type III (Arthus Type)
- Type IV (Delayed Type)

Signs and Symptoms of Anaphylactic Reaction

1. Sense of uneasiness/anxiety
2. Diffuse erythema and feeling of warmth (with or without itching)
3. Hives appearing on the face within the first few seconds after an injection
4. Respiratory Difficulty: Choking sensation, difficulty in swallowing, tightness or pain in the chest, wheezing and shortness of breath, hoarseness
5. Angioedema: CAUTION: With massive facial angioedema, expect that upper respiratory edema may occur
6. Severe abdominal cramps, nausea and vomiting, urinary and bowel incontinence
7. Vascular Collapse: Cyanosis, pallor, imperceptible pulse - circulatory failure leading to coma and death

Documentation of Anaphylactic Reaction

1. DRUG CAUSING THE REACTION:
 - Name of the Drug
 - Date and Time of Administration
 - Route of Administration
 - Site of Administration
 - Amount of Drug Administered when Reaction Occurred
2. ANAPHYLACTIC REACTION:
 - Date and Time
 - All Clinical Signs and Symptoms Exhibited:
 - a. Description
 - b. Time of Occurrence
 - c. Duration of Manifestation
3. EMERGENCY TREATMENT:
 - Date and Time of all Elements of Treatment:
 - a. Airway Establishment
 - b. Intravenous Sites Initiated
 - c. Parenteral Solutions Administered
 - d. Drugs Administered
 - e. Names of Persons Providing Emergency Treatment
4. PATIENT'S RESPONSE TO TREATMENT
5. FOLLOW-UP MONITORING:
 - Vital Signs
 - Observations
6. HEALTH TEACHING:
 - Advisement of Allergy
 - Significance of Allergy
 - Availability of Medical Alert Identification Tags

LESSON PLAN: 3
COURSE TITLE: INTRAVENOUS FLUID THERAPY
UNIT VIII PHARMACOLOGICAL CONSIDERATIONS OF
INTRAVENOUS MEDICATION

SCOPE OF UNIT:

This unit provides the practitioner with information regarding the basic principles of drug action as well as specific considerations associated with the safe and efficient delivery of intravenous drugs, including cytotoxic agents, administered by available intravenous routes.

INFORMATION TOPIC: X OR DEMONSTRATION:

DOSAGE CALCULATIONS IN INTRAVENOUS DRUG ADMINISTRATION
(Lesson Title)

LESSON OBJECTIVES - THE STUDENT WILL BE ABLE TO:

1. Identify terms and abbreviations used in calculating dosages for IV medications.
2. Properly convert equivalencies.
3. Calculate volume needed to give a prescribed dose.
4. Calculate dosage needed to give a prescribed dose.
5. Calculate mcgm/kg/minute.
6. Convert mcgm/kg/minute to mcgtts/minute.

SUPPLEMENTARY TEACHING/LEARNING ITEMS:

1. HO 1: Terms, Abbreviations, and Equivalencies Used in IV Drug Administration
2. HO 2: Formulas for Calculating Drug Doses
3. AS 1: Drug Calculations

INFORMATIONAL ASSIGNMENT:

REFERENCES:

Scherer, Jeanne C., Introductory Clinical Pharmacology. 3rd ed. Philadelphia: J.B. Lippincott Co., 1987.

Johnson, Grace G., Mathematics for Nurses. 2nd ed. Norwalk, CT: Appleton-Century-Crofts, 1986.

INTRODUCTION:

In providing IV drug therapy to the patient, it is essential that precise dosage calculations be made in order that the patient receives the optimal therapeutic effect with minimal potential for error.

LESSON PLAN: 3
COURSE TITLE: INTRAVENOUS FLUID THERAPY
UNIT VIII PHARMACOLOGICAL CONSIDERATIONS OF
INTRAVENOUS MEDICATION

OUTLINE: (Key Points)

I. Terms and Definitions (HO I)

- A. Complex fraction - occurs when both the numerator and the denominator are fractions
- B. Decimal, or decimal fraction - fractions with denominators of 10 or multiples of 10
- C. Denominator - the number below the fraction line; it tells the number of parts into which the quantity is divided
- D. Fraction - one or more parts of a unit of quantity
- E. Improper fraction - a fraction in which the numerator is larger than the denominator
- F. Numerator - the number above the fraction line; it tells how many parts are taken
- G. Percentage - a simple way of expressing fractions with denominators of 100, or its parts of 100
- H. Proper fraction - a fraction in which the numerator is smaller than the denominator
- I. Simple fraction - a proper fraction which has been reduced to its lowest terms

II. Abbreviations (HO I)

- A. Gm - gram or grams
- B. gtt - drop
- C. kg - kilogram
- D. L - liter
- E. lb - pound
- F. mcgm - microgram

- G. mcgtt - microdrop
- H. mEq - milliequivalent
- I. mg - milligram
- J. ml - milliliter
- K. % - percentage

III. Equivalencies (HO I)

- A. 2.2 lb = 1 kg
- B. 1000 Gm = 1 kg
- C. 1 Gm = 1000 mg
- D. 1 mg = 1000 mcgm
- E. 1 L = 1000 ml
- F. 1 ml = 60 mcgtts

IV. Formulas

- A. Convert mg to mcgm equivalency:

$$\# \text{ mg} \times \# \text{ mcgm/mg}$$

$$\text{Example: } 50 \text{ mg} \times 1000 \text{ mcgm/mg} = 50,000 \text{ mcgm}$$

- B. To calculate volume/dosage needed to give a prescribed dosage (two methods):

$$1. \quad \frac{\text{give (dosage)}}{\text{have (dosage)}} \times \frac{\text{volume on hand}}{1} = \text{unknown volume or dosage}$$

Example: give 10 mg; have 15 mg in 10 ml

$$\frac{10 \text{ mg}}{15 \text{ mg}} \times \frac{10 \text{ ml}}{1} = \frac{100}{15} = 6.6 \text{ ml}$$

OR

$$2. \quad \text{have dosage} :: \text{have volume} :: \text{give dosage} :: \text{give volume}$$

- a. Multiply outside factors.
- b. Multiply inside factors.
- c. Divide by X factor for unknown.

Example: give 10 mg; have 15 mg in 10 ml

$$15 \text{ mg} : 10 \text{ ml} :: 10 \text{ mg} : X \text{ ml}$$

$$\begin{aligned} 15 \times X &= 15X \\ 10 \times 10 &= 100 \\ 100 \div 10X &= 6.6 \text{ ml} \end{aligned}$$

- C. To calculate proper dosage of a prescribed order for mcgm/kg/minute:

Example: Order - 2 mcgm/kg/minute
Patient weight - 136
Have - 25 mg/100 ml

Steps

1. Convert patient weight from lb to kg: $136 \div 2.2 = 62 \text{ kg}$
2. mcgm/kg x patient weight: $2 \times 62 = 124 \text{ mcgm/min}$
3. Convert mg to mcgm: $25 \text{ mg} \times 1,000 = 25,000 \text{ mcgm}$
4. Calculate #ml needed to give 124 mcgm/minute:

$$\frac{\text{give } 124 \text{ mcgm}}{\text{have } 25,000 \text{ mcgm}} \times \frac{\text{vol } 100 \text{ ml}}{1} = \frac{12,400}{25,000} = \frac{.5 \text{ ml}}{\text{min}}$$

- D. To convert ml/min x 60 (60 mcgtts/ml)

Example: $.5 \text{ ml/min} \times 60 = 30 \text{ mcgtts/min}$

V. Summary and Conclusion

- A. Terms and definitions
- B. Abbreviations
- C. Equivalencies
- D. Formulas

LESSON PLAN: 3

COURSE TITLE: INTRAVENOUS FLUID THERAPY

UNIT VIII PHARMACOLOGICAL CONSIDERATIONS OF

INTRAVENOUS MEDICATION

INTERACTION ITEMS:

CLASSROOM, LABORATORY, OR OTHER ACTIVITIES:

1. Have students complete AS 1: Drug Calculations.

LESSON PLAN: 3
COURSE TITLE: INTRAVENOUS FLUID THERAPY
UNIT VIII PHARMACOLOGICAL CONSIDERATIONS OF
INTRAVENOUS MEDICATION

EVALUATION ITEMS:

Match the following terms to the correct definitions.

- | | | |
|--------|---|--------------------------------|
| ___ 1. | The number above the fraction line; it tells how many parts are taken | a. Proper fraction |
| ___ 2. | A fraction in which the numerator is smaller than the denominator | b. Simple fraction |
| ___ 3. | One or more parts of a unit of quantity | c. Complex fraction |
| ___ 4. | Occurs when both the numerator and the denominator are fractions | d. Numerator |
| ___ 5. | A proper fraction which has been reduced to its lowest terms | e. Denominator |
| ___ 6. | A simple way of expressing fractions with denominators of 100 or its parts of 100 | f. Decimal or decimal fraction |
| ___ 7. | These are fractions with denominators of 10 or multiples of 100 | g. Fraction |
| ___ 8. | The number below the fraction line; it tells the number of parts into which the quantity is divided | h. Percentage |
| ___ 9. | A fraction in which the numerator is larger than the denominator | i. Improper fraction |

Write the abbreviations for each of the following.

10. Pound: _____
11. Milliliter: _____
12. Drop: _____
13. Milligram: _____
14. Kilogram: _____

- 15. Liters: _____
- 16. Milliequivalent: _____
- 17. Gram or grams: _____
- 18. Microdrop: _____
- 19. Percentage: _____
- 20. Microgram: _____

State the conversion equivalencies for each of the following.

- 21. 1 kg = _____ lb
- 22. 1 kg = _____ Gm
- 23. 1 Gm = _____ mg
- 24. 1 mg = _____ mcgm
- 25. 1 L = _____ ml
- 26. 1 ml = _____ mcgtts

Calculate the following problems.

- 27. The Dr. orders 1 Gm aminophylline in 500 ml. She wants it to infuse @ 36 mg/hr. How many ml is this?

- 28. The Dr. orders: 5 mcgm/kg/min
Patient weight: 120 lbs
Have: 50 mg/200 ml
 - a. How many mcgm/min will you infuse?

 - b. How many ml/min will you infuse?

- c. How many mcgtts/minute will you set to deliver the prescribed dose?
29. If we have 500 ml of D₅W with 25,000 U of heparin in it and we want to infuse 1,000 U/hr into our patient, how many ml/hr do we set the IMED[™] pump for?

LESSON PLAN: 3

COURSE TITLE: INTRAVENOUS FLUID THERAPY

UNIT VIII PHARMACOLOGICAL CONSIDERATIONS OF

INTRAVENOUS MEDICATION

ANSWERS TO EVALUATION ITEMS:

1. d
2. a
3. g
4. c
5. b
6. h
7. f
8. e
9. i
10. lb
11. ml
12. gtt
13. mg
14. kg
15. L
16. mEq
17. Gm
18. mcgtt
19. %
20. mcgm
21. 2.2
22. 1,000
23. 1,000
24. 1,000
25. 1,000
26. 60

27. Step 1: Convert gram into milligram

$$1 \times 1,000 = 1,000 \text{ mg}/500 \text{ ml}$$

Step 2: Calculate volume

$$\frac{36 \text{ mg}}{1,000} \times \frac{500}{1} = \frac{18,000}{1,000} = 18 \text{ ml}$$

OR

$$1,000 \text{ mg} : 500 \text{ ml} :: 36 \text{ mg} : X \text{ ml}$$

$$1,000 \times X = 1,000X$$

$$500 \times 36 = 18,000$$

$$18,000 \div 1,000 X = 18 \text{ ml}$$

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28. a. Step 1: Convert lbs into kg
 $120 \text{ lbs} \div 2.2 = 55 \text{ kg}$
- Step 2: mcgm/kg x patient weight
 $5 \text{ mcgm} \times 55 \text{ kg} = 275 \text{ mcgm/minute}$
- b. Step 1: Convert mg to mcgm
 $50 \text{ mg} \times 1,000 = 50,000 \text{ mcgm/200 ml}$
- Step 2: Calculate volume needed to give
 275 mcgm/minute
- give: $\frac{275 \text{ mcgm}}{50,000 \text{ mcgm}}$ of $\frac{200 \text{ ml}}{1} = \frac{55,000}{50,000} = 1.1 \text{ ml/minute}$
 have:

OR

$$\begin{aligned} 50,000 \text{ mcgm} : 200 \text{ ml} &:: 275 \text{ mcgm} : X \text{ ml} \\ 50,000 \times X &= 50,000X \\ 200 \times 275 &= 55,000 \\ 55,000 \div 50,000 &= 1.1 \text{ ml/minute} \end{aligned}$$

- c. Convert ml to mcgtts
 $1.1 \text{ ml} \times 60 = 66 \text{ mcgtts/min}$

29. Calculate volume needed to give 1,000 U/hr
- give: $\frac{1,000 \text{ U}}{25,000 \text{ U}} \times \frac{500 \text{ ml}}{1} = \frac{500,000}{25,000} = 20 \text{ ml/hour}$
 have:

OR

$$\begin{aligned} 25,000 \text{ U} : 500 \text{ ml} &:: 1000 \text{ U} : X \text{ ml} \\ 25,000X & \\ 500 \times 1,000 &= 500,000 \\ 500,000 \div 25,000 &= 20 \text{ ml/hr} \end{aligned}$$

Terms, Abbreviations, and Equivalencies Used in Calculating Dosages for IV Medications

Terms and Definitions

COMPLEX FRACTION - occurs when both the numerator and denominator are fractions

DECIMAL, OR DECIMAL FRACTION - fractions with denominators of 10 or multiples of 10

DENOMINATOR - the number below the fraction line; telling the number of parts into which the quantity is divided

FRACTION - one or more parts of a unit of quantity

IMPROPER FRACTION - a fraction in which the numerator is bigger than the denominator

NUMERATOR - the number above the fraction line; telling how many parts are taken

PERCENTAGE - a simple way of expressing fractions with denominators of 100, or its parts of 100

PROPER FRACTION - a fraction that exists when the numerator is smaller than the denominator

SIMPLE FRACTION - a proper fraction which has been reduced to its lowest common terms

Abbreviations	Equivalencies
Gm - gram or grams	2.2 lb = 1 kg
gtt - drop	1000 Gm = 1 kg
kg - kilogram	1 Gm = 1000 mg
L - liter	1 mg = 1000 mcgm
lb - pound	1 L = 1000 ml
mcgm - microgram	1 ml = 60 mcgtts
mcgtt - microdrop	
mEq - milliequivalent	
mg - milligram	
ml - milliliter	
% - percentage	

Formulas for Calculating Drug Doses

$$1. \frac{\text{DOSAGE TO GIVE}}{\text{DOSAGE ON HAND}} \times \frac{\text{VOLUME ON HAND}}{1} = \text{UNKNOWN VOLUME OR DOSAGE}$$

Example:

You want 300 mg of aminophylline.
You have on hand 500 mg in 500 ml.

$$\frac{300 \text{ mg}}{500 \text{ mg}} \times \frac{500}{1} \times \frac{150,000}{500} = 300 \text{ ml}$$

or

2.

$$\text{DOSE : } \overbrace{\text{VOLUME}} \text{ : : DOSE : VOLUME}$$

Multiply inside numbers.

Divide unknown into known.

Example:

You want 300 mg of aminophylline.
You have on hand 500 mg in 500 ml.

$$500 \text{ mg : } \overbrace{500 \text{ ml}} \text{ : : } 300 \text{ mg : } X \text{ ml}$$

$$500 \times X = 500X$$

$$500 \times 300 = 150,000$$

$$150,000 \div 500 = 300 \text{ ml}$$

ASSIGNMENT SHEET 1: DRUG CALCULATIONS

Directions: Answer the following questions by utilizing the information on terms, abbreviations, and equivalencies you have learned in this unit. Show your work.

1. A patient who weighs 150 lb weighs how many kg? _____
2. 200 mg = _____ mcgm
3. Add _____ ml KCl 25 mEq to present IV fluid. Vial states 40mEq/20 ml.
4. A heparin infusion of 25,000 U in 250 ml is ordered. The heparin vial states 5,000 U/ml.
 - a. How many ml of heparin do you need to give 25,000 U? _____
 - b. What is the concentration of heparin/ml? _____
 - c. Dr. orders 1,600 U to infuse every hour. How many ml is this per hour? _____
 - d. Dr. orders 20,000 U in 500 ml to infuse @ 800 U/hr. How many ml is this? _____

ANSWERS TO ASSIGNMENT SHEET 1: DRUG CALCULATIONS

1. $150 \div 2.2 = \underline{68 \text{ kg}}$

2. $200 \times 1,000 = \underline{200,000 \text{ mcgm}}$

3.
$$\frac{\text{give: } 25 \text{ mEq}}{\text{have: } 40 \text{ mEq}} \times \frac{\text{Vol - } 20 \text{ ml}}{1} = \frac{500}{40} = \underline{12.5 \text{ ml}}$$

4. a.
$$\frac{\text{give: } 25,000 \text{ U}}{\text{have: } 5,000} \times \frac{1 \text{ ml}}{1} \times \frac{25,000}{5,000} = \underline{5 \text{ ml}}$$

or

$$5,000 : 1 \text{ ml} :: 25,000 : X \text{ ml}$$

$$25,000 \div 5,000 X = \underline{5 \text{ ml}}$$

b.
$$\frac{5 : 250}{1 : 50}$$

c.
$$\frac{\text{give: } 1,600 \text{ U}}{\text{have: } 25,000} \times \frac{250 \text{ ml}}{1} = \frac{400,000}{25,000} = \underline{16 \text{ ml}}$$

or

$$25,000 \text{ U} : 250 \text{ ml} :: 1,600 \text{ U} : X \text{ ml}$$

$$400,000 \div 25,000 X = \underline{16 \text{ ml}}$$

d.
$$\frac{\text{give: } 800 \text{ U}}{\text{have: } 20,000} \times \frac{500 \text{ ml}}{1} = \frac{400,000}{20,000} = \underline{20 \text{ ml}}$$

or

$$20,000 : 500 :: 800 : X$$

$$400,000 \div 20,000 X = \underline{20 \text{ ml}}$$

LESSON PLAN: 4
COURSE TITLE: INTRAVENOUS FLUID THERAPY
UNIT VIII PHARMACOLOGICAL CONSIDERATIONS OF
INTRAVENOUS MEDICATION

SCOPE OF UNIT:

This unit provides the practitioner with information regarding the basic principles of drug action as well as specific considerations associated with the safe and efficient delivery of intravenous drugs, including cytotoxic agents, administered by available intravenous routes.

INFORMATION TOPIC: OR DEMONSTRATION: X

PIGGYBACK ADMINISTRATION OF INTRAVENOUS DRUGS WITH CONTINU-FLO TUBING
(Lesson Title)

LESSON OBJECTIVE - THE STUDENT WILL BE ABLE TO:

1. Administer IV piggyback medications with continu-flo tubing according to the steps of procedure.

SUPPLEMENTARY TEACHING/LEARNING ITEMS:

1. HO 1: Automatic IV Piggyback Set
2. Containers of primary IV fluids
3. IV administration sets with piggyback ports ("Y"-ports)
4. Small containers of medicant fluid
5. Short secondary administration sets with hangers
6. 20 and 23 gauge 1/2 - 3/4" needles
7. IV standards
8. Tape
9. Alcohol swabs

INFORMATIONAL ASSIGNMENT:

Plumer, Ada Lawrence. Principles and Practice of Intravenous Therapy. 4th ed. Boston: Little, Brown & Co., 1987.

Nursing '80 PhotoBook Series, Managing IV Therapy. Horsham, PA: Intermed Communications Inc., 1980, pp. 71; 74; 77.

REFERENCES:

Plumer, Ada Lawrence. Principles and Practice of Intravenous Therapy. 4th ed. Boston: Little, Brown & Co., 1987.

Nursing '80 PhotoBook Series, Managing IV Therapy. Horsham, PA: Intermed Communications Inc., 1980, pp. 71; 74; 77.

INTRODUCTION:

This lesson demonstrates piggyback administration of an IV drug with a Continu-Flo administration set.

LESSON PLAN: 4
COURSE TITLE: INTRAVENOUS FLUID THERAPY
UNIT VIII PHARMACOLOGICAL CONSIDERATIONS OF
INTRAVENOUS MEDICATION

STEPS OF PROCEDURE:

- I. Procedure for Piggyback Administration of IV Drug With Continu-Flo Tubing
 - A. Wash hands.
 - B. Using the accompanying hanger, lower the height of the primary solution container by attaching hanger to IV standard and primary solution container to lower loop of hanger.
 - C. Close clamp on secondary set.
 - D. Remove cover from spike of secondary set.
 - E. Squeeze drip chamber.
 - F. Insert connector into outer port of secondary medication container.
 - G. Suspend container.
 - H. Squeeze and release chamber until half-filled.
 - I. Remove protector from needle; maintain sterility of both protector and needle.
 - J. Partially open roller clamp and prime tubing slowly.
 - K. Close clamp.
 - L. Recover needle.
 - M. Label secondary administration set.
 - N. Prepare upper "Y"-port (piggyback port) on primary administration set with antiseptic for one (1) minute.
 - O. Insert needle.
 - P. Secure needle in place with tape in "sandwich" fashion with a courtesy tag.
 - Q. Open secondary control clamp fully.
 - R. Adjust flow of piggyback fluid to patient using flow control clamp on primary administration set.

- S. Document (medex/nurse's notes).
- II. Summary and Conclusion
 - A. Ask interaction items.
 - B. Review steps of procedure.

LESSON PLAN: 4
COURSE TITLE: INTRAVENOUS FLUID THERAPY
UNIT VIII PHARMACOLOGICAL CONSIDERATIONS OF
INTRAVENOUS MEDICATION

INTERACTION ITEMS:

1. Why must the primary IV container be positioned below the piggyback container?
2. Which clamp is used to adjust flow rate when hanging an IV piggyback?

CLASSROOM, LABORATORY, OR OTHER ACTIVITIES:

1. Prepare courtesy tags.
2. Tape connection sites.
3. Practice procedure.

LESSON PLAN: 4

COURSE TITLE: INTRAVENOUS FLUID THERAPY

UNIT VIII PHARMACOLOGICAL CONSIDERATIONS OF
INTRAVENOUS MEDICATION

EVALUATION ITEMS: NAME OF STUDENT: _____

PIGGYBACK ADMINISTRATION OF IV DRUG WITH CONTINU-FLO TUBING

EQUIPMENT:

1. Container of primary IV fluids
2. IV administration set with piggyback port (Y-port)
3. Small container of medicant fluid
4. Short secondary administration set with hanger
5. 20 and 23 gauge 1/2 - 3/4" needle
6. IV standard
7. Tape
8. Alcohol swabs

DID THE STUDENT:	YES	NO
1. Wash hands.		
2. Lower height of primary solution container.		
3. Close clamp on secondary set.		
4. Remove cover from spike of secondary set.		
5. Squeeze drip chamber.		
6. Insert connector into outer port of secondary medication container.		
7. Suspend container.		
8. Squeeze and release chamber until half-filled.		
9. Remove protector from needle.		
10. Partially open roller clamp and prime tubing slowly.		
11. Close clamp and recover needle.		
12. Label secondary administration set.		
13. Prepare upper "Y"-port on primary administration set with antiseptic for one (1) minute.		

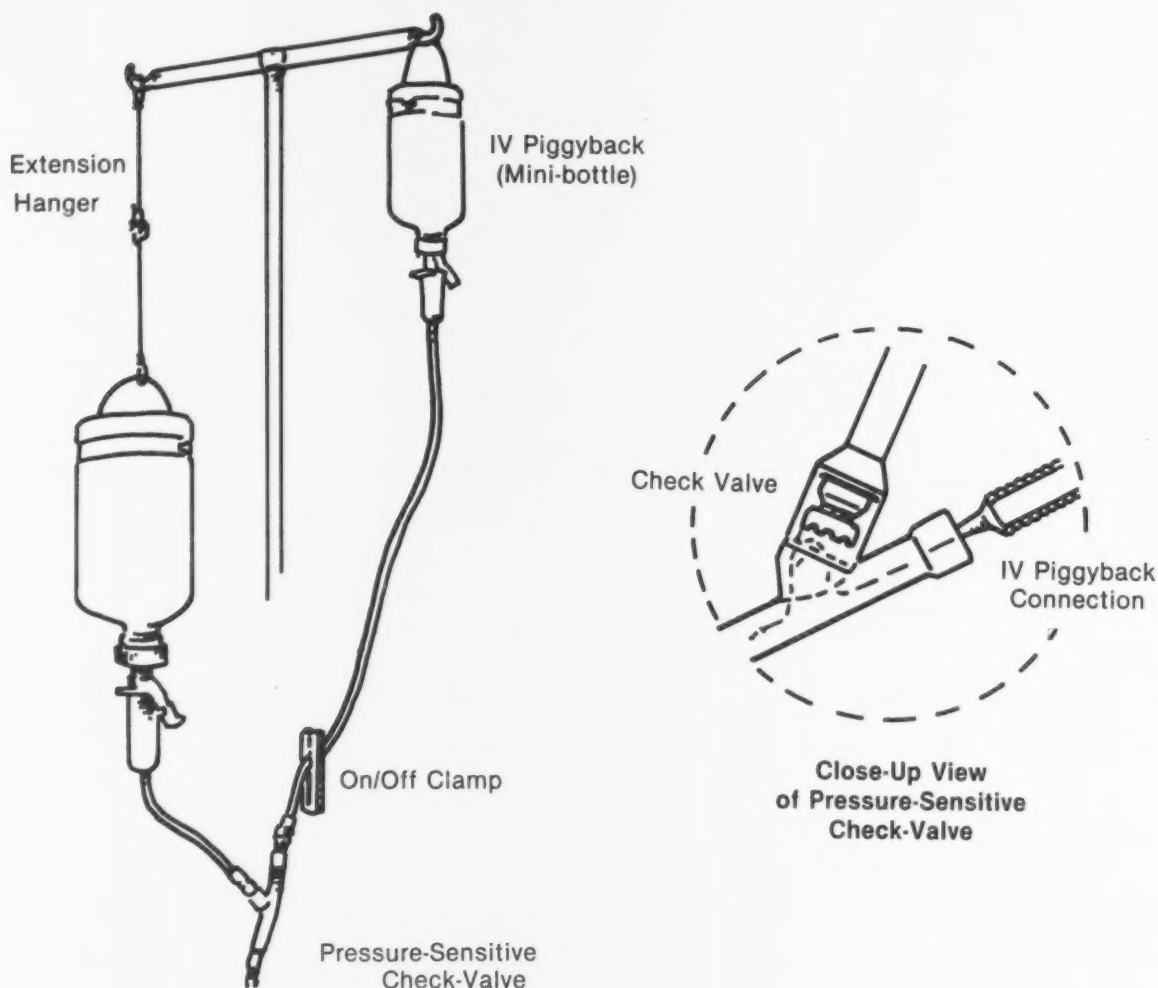
DID THE STUDENT:	YES	NO
14. Insert needle and secure in place with tape in "sandwich" fashion with courtesy tag.		
15. Open secondary control clamp fully.		
16. Adjust flow of piggyback fluid with clamp on primary administration set.		
17. Document (medex/nurse's notes).		

The student has satisfactorily completed the procedure "PIGGYBACK ADMINISTRATION OF IV DRUG WITH CONTINU-FLO TUBING" according to the steps outlined.

Instructor's/Charge Personnel's Signature
(Verifying Satisfactory Completion)

Date

Automatic IV Piggyback Set



Automatic piggyback sets are available from most manufacturers of IV administration equipment. Such sets contain a built-in pressure sensitive check-valve.

When a piggyback is connected to one of these sets and the flow clamp is opened, the check-valve automatically closes off the primary infusion.

When the infusion of the piggyback has been completed, the check-valve automatically opens, thereby restarting the primary infusion.

The check-valve works because of pressure differences. To achieve this difference it is imperative that the primary infusion container is hung lower than the secondary piggyback container by means of an extension hanger. Such hangers which may be plastic or metal are supplied by the manufacturer and are usually contained in the secondary administration set packaging.

CAUTION: The flow clamps of the secondary medication administration sets are considered **STRICTLY** on/off clamps and are not intended to be utilized as a flow regulating clamp.

LESSON PLAN: 5
COURSE TITLE: INTRAVENOUS FLUID THERAPY
UNIT VIII PHARMACOLOGICAL CONSIDERATIONS OF
INTRAVENOUS MEDICATION

SCOPE OF UNIT:

This unit provides the practitioner with information regarding the basic principles of drug action as well as specific considerations associated with the safe and efficient delivery of intravenous drugs, including cytotoxic agents, administered by available intravenous routes.

INFORMATION TOPIC: OR DEMONSTRATION: X

PIGGYBACK ADMINISTRATION OF INTRAVENOUS DRUGS VIA HEPARIN LOCK
(Lesson Title)

LESSON OBJECTIVE - THE STUDENT WILL BE ABLE TO:

1. Administer IV piggyback medications via heparin lock according to the steps of procedure.

SUPPLEMENTARY TEACHING/LEARNING ITEMS:

1. HO 1: SASH Flush
2. HO 2: Straight Line into Heparin Lock
3. Small containers of medicant fluid
4. Secondary solution administration sets
5. Anatomical model with established heparin lock
6. Alcohol swabs
7. Syringes containing 1 ml normal saline
8. 20 and 23 gauge 1/2 - 3/4" needles (sterile)
9. Syringe representing 1 cc heparinized saline
10. IV standard
11. Tape

INFORMATIONAL ASSIGNMENT:

Plumer, Ada Lawrence. Principles and Practice of Intravenous Therapy. 4th ed. Boston: Little, Brown & Co., 1987.

Nursing '80 PhotoBook Series, Managing IV Therapy. Horsham, PA: Intermed Communications Inc., 1980.

REFERENCES:

Plumer, Ada Lawrence. Principles and Practice of Intravenous Therapy. 4th ed. Boston: Little, Brown & Co., 1987.

Nursing '80 PhotoBook Series, Managing IV Therapy. Horsham, PA: Intermed Communications Inc., 1980.

INTRODUCTION:

This lesson covers the procedure of piggyback administration of IV drugs via the heparin lock.

LESSON PLAN: 5

COURSE TITLE: INTRAVENOUS FLUID THERAPY

UNIT VIII PHARMACOLOGICAL CONSIDERATIONS OF
INTRAVENOUS MEDICATION

STEPS OF PROCEDURE:

- I. Procedure for Piggyback Administration of IV Drugs Via Heparin Lock
 - A. Wash hands.
 - B. Close clamp on secondary administration set.
 - C. Remove cover from spike on secondary administration set.
 - D. Squeeze drip chamber.
 - E. Insert spike into port of piggyback container.
 - F. Suspend container.
 - G. Squeeze and release chamber until half-filled.
 - H. Remove protector from needle.
 - I. Partially open roller clamp and prime tubing slowly.
 - J. Close clamp.
 - K. Recover needle.
 - L. Label secondary administration set.
 - M. Prepare heparin lock medication port with antiseptic for one (1) minute.
 - N. Insert needle of syringe with N/S into heparin lock medication port, aspirate for blood return and flush over one (1) minute, checking patency of heparin lock. (HO-1) (II-1)
 - O. Securely engage needle of administration set into heparin lock. (HO-2)
 - P. Secure needle in place in "sandwich" fashion with courtesy tabs.
 - Q. Open secondary administration set control clamp and adjust flow rate.
 - R. Examine site for any signs of complications.

II. After the Drug Has Been Administered

- A. Close control clamp on secondary administration set.
- B. Remove needle from heparin lock while stabilizing the lock.
- C. Replace used needle with sterile needle with cover intact to secondary administration set.
- D. Aseptically flush heparin lock with N/S over one (1) minute. (II-2)
- E. Aseptically flush lock with heparinized solution over one (1) minute.
CAUTION: All flushes to be done over one (1) minute.
- F. Document - medication and heparin flush.

III. Summary and Conclusion

- A. Ask interaction items.
- B. Review steps of procedure.

LESSON PLAN: 5

COURSE TITLE: INTRAVENOUS FLUID THERAPY

UNIT VIII PHARMACOLOGICAL CONSIDERATIONS OF
INTRAVENOUS MEDICATION

INTERACTION ITEMS:

1. Why flush the heparin lock with N/S prior to and after administering medication?
2. Why should all flushes be done over a time span of one (1) minute?

CLASSROOM, LABORATORY, OR OTHER ACTIVITIES:

1. Practice procedure including taping and flushes.

LESSON PLAN: 5

COURSE TITLE: INTRAVENOUS FLUID THERAPY

UNIT VIII PHARMACOLOGICAL CONSIDERATIONS OF
INTRAVENOUS MEDICATION

EVALUATION ITEMS: NAME OF STUDENT: _____

PIGGYBACK ADMINISTRATION OF IV DRUGS VIA HEPARIN LOCK

EQUIPMENT:

1. Small container of medicant fluid
2. Secondary solution administration set
3. Anatomical model with established heparin lock
4. Alcohol swabs
5. Syringe containing 1 ml normal saline
6. 20 and 23 gauge 1/2 - 3/4" needle (sterile)
7. Syringe representing 1 cc heparinized saline
8. IV standard
9. Tape

DID THE STUDENT:	YES	NO
1. Wash hands.		
2. Close clamp on secondary administration set.		
3. Remove cover from spike on secondary administration set.		
4. Squeeze drip chamber while inserting spike into piggyback container.		
5. Suspend container.		
6. Squeeze and release drip chamber until half-filled.		
7. Remove protector from needle.		
8. Partially open roller clamp and prime tubing slowly.		
9. Close clamp and recover needle.		
10. Label secondary administration set.		
11. Prepare heparin lock medication port with antiseptic for one (1) minute.		

DID THE STUDENT:	YES	NO
12. Insert needle of syringe with N/S into heparin lock medication port. Aspirate for blood return and flush over (1) minute checking patency of heparin lock.		
13. Insert needle of administration set and secure with courtesy tape.		
14. Open secondary administration set control clamp and adjust flow rate.		
15. Examine site for any signs of complications.		
<u>After drug has been administered:</u>		
16. Close control clamp on secondary administration set.		
17. Remove needle from heparin lock while stabilizing the lock.		
18. Replace used needle with sterile needle with cover intact to secondary administration set.		
19. Aseptically flush heparin lock with N/S over one (1) minute.		
20. Aseptically flush heparin lock with heparinized solution over one (1) minute.		
21. Document medication and heparin flush.		

The student has satisfactorily completed the procedure "PIGGYBACK ADMINISTRATION OF IV DRUGS VIA HEPARIN LOCK" according to the steps outlined.

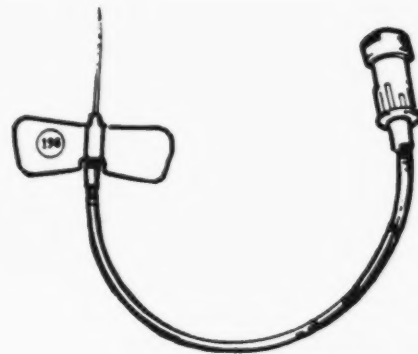
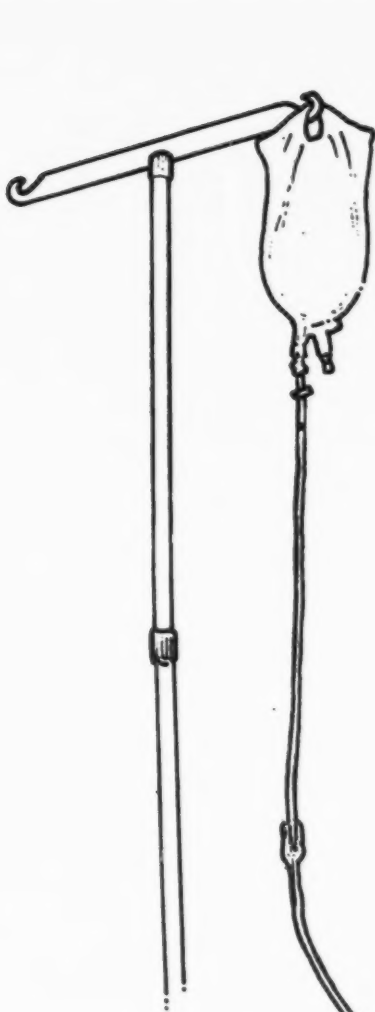
Instructor's/Charge Personnel's Signature
(Verifying Satisfactory Completion)

Date

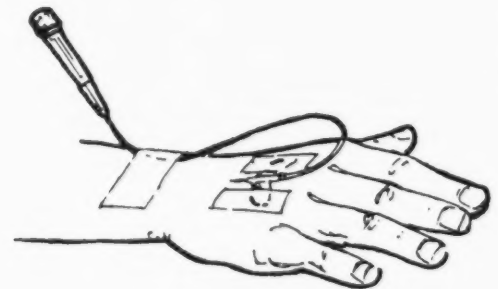
SASH Flush

S	Saline
A	Administration of Ordered Medication
S	Saline
H	Heparinization

Straight Line into Heparin Lock



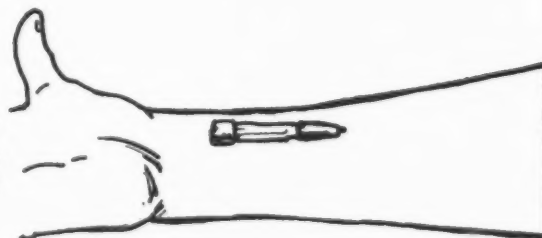
Winged infusion set with factory-attached permanent injection site and short length of flexible tubing



Male Luer adapter with injection site connected to a winged infusion set



Male Luer adapter with injection site connected to an IV catheter



LESSON PLAN: 6
COURSE TITLE: INTRAVENOUS FLUID THERAPY
UNIT VIII PHARMACOLOGICAL CONSIDERATIONS OF
INTRAVENOUS MEDICATION

SCOPE OF UNIT:

This unit provides the practitioner with information regarding the basic principles of drug action as well as specific considerations associated with the safe and efficient delivery of intravenous drugs, including cytotoxic agents, administered by available intravenous routes.

INFORMATION TOPIC: OR DEMONSTRATION: X

PIGGYBACK ADMINISTRATION OF INTRAVENOUS DRUGS VIA SECONDARY LINE
WITH ESTABLISHED PRIMARY LINE
(Lesson Title)

LESSON OBJECTIVE - THE STUDENT WILL BE ABLE TO:

1. Administer IV piggyback medications via secondary line with established primary line according to the steps of procedure.

SUPPLEMENTARY TEACHING/LEARNING ITEMS:

1. HO 1: Intravenous Piggyback via Secondary Line
2. Established primary IV fluids with primary line
3. Small containers of medicant fluid
4. Secondary solution administration sets
5. Alcohol swabs
6. Tape
7. 20-23 gauge 3/4"-1" needles
8. Puncture-proof needle container 466
9. Tubing change label

INFORMATIONAL ASSIGNMENT:

Plumer, Ada Lawrence. Principles and Practice of Intravenous Therapy. 4th ed. Boston: Little, Brown & Co., 1987.

Nursing '80 PhotoBook Series, Managing IV Therapy. Horsham, PA: Intermed Communications Inc., 1980.

REFERENCES:

Plumer, Ada Lawrence. Principles and Practice of Intravenous Therapy. 4th ed. Boston: Little, Brown & Co., 1987.

Nursing '80 PhotoBook Series, Managing IV Therapy. Horsham, PA: Intermed Communications Inc., 1980.

INTRODUCTION:

This lesson covers piggyback administration of IV drugs via a secondary line with an established primary line.

LESSON PLAN: 6
COURSE TITLE: INTRAVENOUS FLUID THERAPY
UNIT VIII PHARMACOLOGICAL CONSIDERATIONS OF
INTRAVENOUS MEDICATION

STEPS OF PROCEDURE:

- I. Piggyback Administration of IV Drugs Via Secondary Line With Established Primary Line
 - A. Wash hands.
 - B. Close clamp on secondary administration set.
 - C. Remove cover from spike on secondary administration set.
 - D. Squeeze drip chamber.
 - E. Insert spike into port of piggyback container.
 - F. Suspend container.
 - G. Squeeze and release chamber until half-filled.
 - H. Remove protector from needle; maintain sterility of needle and protector.
 - I. Partially open roller clamp and prime tubing slowly.
 - J. Close clamp.
 - K. Recover needle.
 - L. Label secondary administration set.
 - M. Prepare the primary line's lower "Y"-port (secondary port) with antiseptic for one (1) minute.
 - N. Insert needle.
 - O. Secure needle to port with tape in "sandwich" fashion with courtesy tab.
 - P. Open secondary administration set control clamp and adjust flow rate for piggyback medication.

NOTE: A secondary set is used to administer drugs intermittently or simultaneously with a primary solution.

II. After the Drug Has Been Administered

- A. Close control clamp on secondary administration set.
- B. Disattach piggyback connection.
- C. Remove used needle and place in puncture-proof container.
- D. Place new sterile needle with protective cover on secondary administration set.
- E. Place secondary administration set out of patient's reach.
- F. Document procedure.

III. Summary and Conclusion

- A. Ask interaction items.
- B. Review steps of procedure.

LESSON PLAN: 6

COURSE TITLE: INTRAVENOUS FLUID THERAPY

UNIT VIII PHARMACOLOGICAL CONSIDERATIONS OF
INTRAVENOUS MEDICATION

INTERACTION ITEMS:

1. Does it make any difference which port on the primary administration set is used to administer piggyback medications when using a secondary set?
2. Which control clamp regulates the flow of the piggyback drug when using a secondary set?
3. What is done with the secondary administration set and needle after the drug dose has been given?

CLASSROOM, LABORATORY, OR OTHER ACTIVITIES:

1. Practice procedure.

LESSON PLAN: 6

COURSE TITLE: INTRAVENOUS FLUID THERAPY

UNIT VIII PHARMACOLOGICAL CONSIDERATIONS OF
INTRAVENOUS MEDICATION

EVALUATION ITEMS: NAME OF STUDENT: _____

PIGGYBACK ADMINISTRATION OF INTRAVENOUS DRUGS VIA SECONDARY LINE
WITH ESTABLISHED PRIMARY LINE

EQUIPMENT:

1. Established primary IV fluid with primary line
2. Small container of medicant fluid
3. Secondary solution administration set
4. Alcohol swabs
5. Tape
6. 20-23 gauge 3/4"-1" needle
7. Puncture-proof needle container
8. Tubing change label

DID THE STUDENT:	YES	NO
1. Wash hands.		
2. Close clamp on secondary administration set.		
3. Remove cover from spike on secondary administration set.		
4. Squeeze drip chamber while inserting spike into piggyback container.		
5. Suspend container.		
6. Squeeze and release drip chamber until half-filled.		
7. Remove protector from needle, partially open roller clamp and prime tubing slowly.		
8. Close clamp and recover needle.		
9. Label secondary administration set.		
10. Prepare primary line's lower "Y"-port (secondary port) with antiseptic for one (1) minute.		
11. Insert needle of secondary administration set.		
12. Secure needle to port with tape courtesy tab.		

DID THE STUDENT:	YES	NO
13. Open secondary administration set control clamp and adjust flow rate for piggyback medication.		
<u>After drug has been administered:</u>		
14. Close control clamp on secondary administration set.		
15. Disattach piggyback connection.		
16. Remove used needle and place in puncture-proof needle container.		
17. Place new needle with protective cover on secondary administration set.		
18. Place secondary administration set out of patient's reach.		
19. Document.		

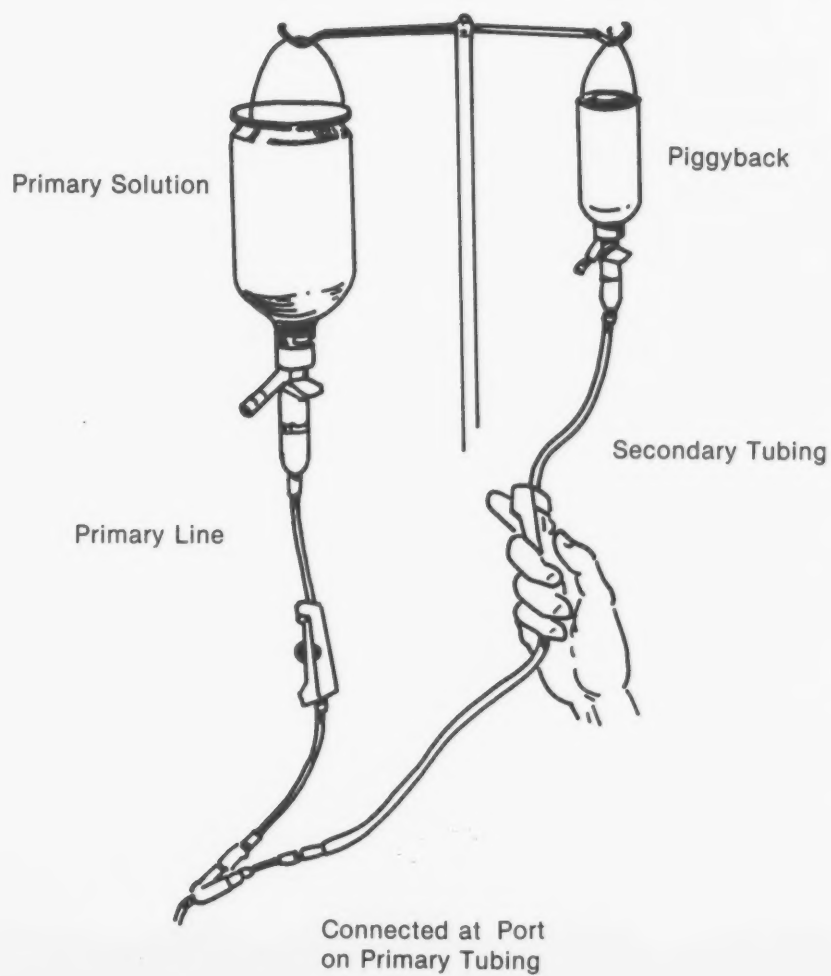
The student has satisfactorily completed the procedure "PIGGYBACK ADMINISTRATION OF IV DRUGS VIA SECONDARY LINE WITH ESTABLISHED PRIMARY LINE" according to the steps outlined.

Instructor's/Charge Personnel's Signature
(Verifying Satisfactory Completion)

Date

472

Intravenous Piggyback via Secondary Line



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LESSON PLAN: 7
COURSE TITLE: INTRAVENOUS FLUID THERAPY
UNIT VIII PHARMACOLOGICAL CONSIDERATIONS OF
INTRAVENOUS MEDICATION

SCOPE OF UNIT:

This unit provides the practitioner with information regarding the basic principles of drug action as well as specific considerations associated with the safe and efficient delivery of intravenous drugs, including cytotoxic agents, administered by available intravenous routes.

INFORMATION TOPIC: OR DEMONSTRATION: X

ADMINISTRATION OF INTRAVENOUS DRUGS VIA VOLUME-CONTROL SET
(Lesson Title)

LESSON OBJECTIVE - THE STUDENT WILL BE ABLE TO:

1. Administer IV medications via volume-control set according to the steps of procedure.

SUPPLEMENTARY TEACHING/LEARNING ITEMS:

1. HO 1: Medication Administration via Volume-Control Set
2. Volume-control administration sets (Buretrol or Solusets)
3. Containers of primary IV fluids
4. Anatomical model with cannula inserted ready for attachment to volume-control sets
5. Tape

INFORMATIONAL ASSIGNMENT:

Nursing '80 PhotoBook Series, Managing IV Therapy. Horsham, PA: Intermed Communications Inc., 1980, pp. 76-80.

REFERENCES:

Plumer, Ada Lawrence. Principles and Practice of Intravenous Therapy. 4th ed. Boston: Little, Brown & Co., 1987, p. 5.

Nursing '80 PhotoBook Series, Managing IV Therapy. Horsham, PA: Intermed Communications Inc., 1980, pp. 76-80.

INTRODUCTION:

This lesson demonstrates administration of IV drugs via volume-control set.

LESSON PLAN: 7

COURSE TITLE: INTRAVENOUS FLUID THERAPY

UNIT VIII PHARMACOLOGICAL CONSIDERATIONS OF
INTRAVENOUS MEDICATION

STEPS OF PROCEDURE:

I. Procedure for Administration of IV Drugs via Volume-Control Set

- A. Wash hands.
- B. Open chamber air vent according to manufacturer's instructions.
- C. Close upper control clamp.
- D. Push lower control clamp to just below lower drip chamber and close it.
NOTE: Never leave both control clamps open simultaneously--will create unregulated fluid flow.
- E. Remove cover from spike on volume-control set.
- F. Squeeze drip chamber.
- G. Insert spike into container of primary IV fluid.
- H. Suspend container.
- I. Open volume-control set's upper control clamp and allow prescribed amount of fluid into fluid chamber.
- J. Close upper clamp.
- K. Squeeze and release lower drip chamber until half-filled.
- L. Open lower control clamp and slowly prime tubing.
- M. Close lower control clamp.
- N. Attach volume-control set to inserted cannula or add as a secondary line to primary line or heparin lock.
- O. Open lower control clamp and adjust to ordered flow rate.
- P. Label volume-control administration set with time for change.
- Q. Document.

II. Summary and Conclusion

- A. Ask interaction items.
- B. Review steps of procedure.

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LESSON PLAN: 7

COURSE TITLE: INTRAVENOUS FLUID THERAPY

UNIT VIII PHARMACOLOGICAL CONSIDERATIONS OF

INTRAVENOUS MEDICATION

INTERACTION ITEMS:

1. Should the fluid chamber always be squeezed initially to fill with some fluid?
2. Can both control clamps be left open simultaneously? Why or why not?

CLASSROOM, LABORATORY, OR OTHER ACTIVITIES:

1. Practice setting up volume-control sets with containers of primary fluid.

LESSON PLAN: 7

COURSE TITLE: INTRAVENOUS FLUID THERAPY

UNIT VIII PHARMACOLOGICAL CONSIDERATIONS OF

INTRAVENOUS MEDICATION

EVALUATION ITEMS: NAME OF STUDENT: _____

ADMINISTRATION OF IV DRUGS VIA VOLUME-CONTROL SET

EQUIPMENT:

1. Volume-control administration set (Buretrol or Solusets)
2. Container of primary IV fluids
3. Anatomical model with cannula inserted ready for attachment to volume-control sets
4. Tape
5. Label for equipment change time

DID THE STUDENT:	YES	NO
1. Wash hands.		
2. Open chamber air vent according to manufacturer's instructions.		
3. Close upper control clamp.		
4. Push lower control clamp to just below lower drip chamber and close it.		
5. Remove cover from spike on volume-control set.		
6. Squeeze drip chamber while inserting spike into container of primary IV fluid.		
7. Suspend container.		
8. Open volume-control set's upper control clamp.		
9. Fill fluid chamber with prescribed amount of fluid.		
10. Close upper clamp.		
11. Squeeze and release lower drip chamber until half-filled.		

DID THE STUDENT:	YES	NO
12. Open lower control clamp and slowly prime tubing.		
13. Close lower control clamp.		
14. Attach volume-control set to inserted cannula or add as a secondary line to primary line or heparin lock.		
15. Open lower control clamp and adjust to ordered flow rate.		
16. Label volume-control administration set as to the time for change.		
17. Document.		

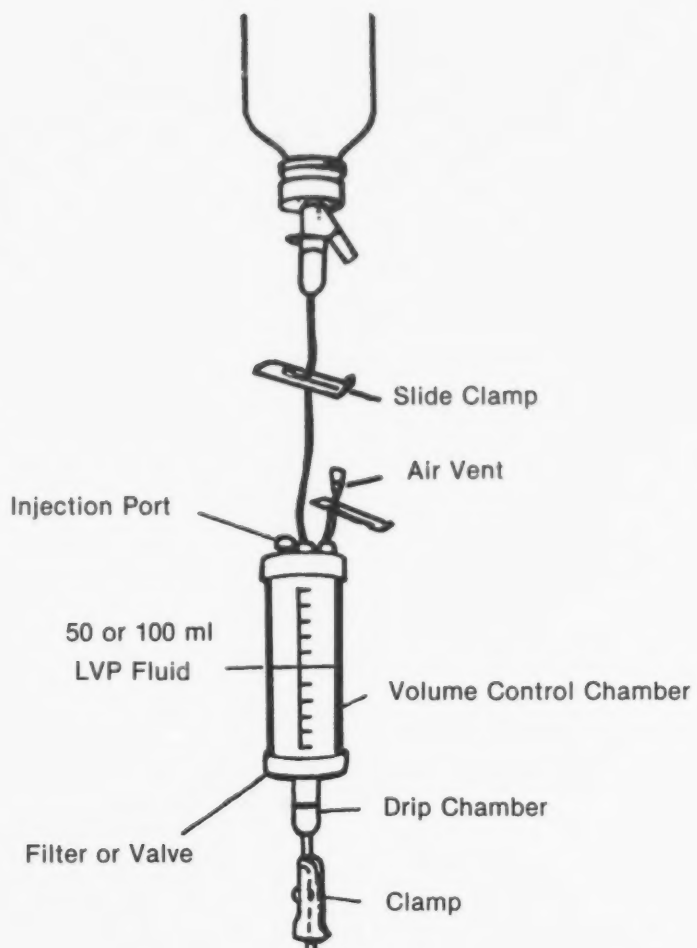
The student has satisfactorily completed the procedure "ADMINISTRATION OF IV DRUGS VIA VOLUME-CONTROL SET" according to the steps outlined.

Instructor's/Charge Personnel's Signature
(Verifying Satisfactory Completion)

Date

480

Medication Administration via Volume-Control Set



LESSON PLAN: 8
COURSE TITLE: INTRAVENOUS FLUID THERAPY
UNIT VIII PHARMACOLOGICAL CONSIDERATIONS OF
INTRAVENOUS MEDICATION

SCOPE OF UNIT:

This unit provides the practitioner with information regarding the basic principles of drug action as well as specific considerations associated with the safe and efficient delivery of intravenous drugs, including cytotoxic agents, administered by available intravenous routes.

INFORMATION TOPIC: OR DEMONSTRATION: X

DRUG ADMINISTRATION VIA DIRECT INJECTION
(Lesson Title)

NOTE: CSR200-6.010 (I), (D), (4) "Licensed Practical Nurses MAY NOT perform the following functions or duties related to the administration of intravenous fluid treatments... (I)

Administering drugs IV push (life-threatening circumstances may necessitate the administration of IV push medications by experienced/qualified licensed practical nurses under the direction of a registered nurse or physician.)

LESSON OBJECTIVE - THE STUDENT WILL BE ABLE TO:

1. Administer medication via direct injection according to the steps of procedure.

SUPPLEMENTARY TEACHING/LEARNING ITEMS:

1. Anatomical model with attached heparin lock or administration set
2. Syringe and needle with solution representing drug to be administered
3. Alcohol sponge
4. Watch or easily-read clock with sweep second hand
5. Puncture-proof needle container

INFORMATIONAL ASSIGNMENT:

Plumer, Ada Lawrence. Principles and Practice of Intravenous Therapy. 4th ed. Boston: Little, Brown & Co., 1987.

Nursing '80 PhotoBook Series, Managing IV Therapy. Horsham, PA: Intermed Communications Inc., 1980, pp. 81-86.

REFERENCES:

Plumer, Ada Lawrence. Principles and Practice of Intravenous Therapy. 4th ed. Boston: Little, Brown & Co., 1987.

Nursing '80 PhotoBook Series, Managing IV Therapy. Horsham, PA: Intermed Communications Inc., 1980, pp. 81-86.

INTRODUCTION:

This lesson covers the procedure for administering drugs via direct injection—a procedure that may be performed by a qualified LPN under the direction of a registered nurse or physician only in the event of emergency life-threatening circumstances.

LESSON PLAN: 8
COURSE TITLE: INTRAVENOUS FLUID THERAPY
UNIT VIII PHARMACOLOGICAL CONSIDERATIONS OF
INTRAVENOUS MEDICATION

STEPS OF PROCEDURE:

I. Procedure for Drug Administration via Direct Injection

A. Through a primary line with compatible solution

1. Wash hands.
2. Cleanse lowest port of administration set with antiseptic solution over one (1) minute.
3. Insert needle of medication syringe into port.
4. Close the roller clamp. (II-1)
5. Aspirate for blood backflow to verify cannula placement. (II-2)
6. Inject medication at prescribed rate.
7. Remove syringe/needle while grasping port.
8. Place syringe/needle in puncture-proof container. Do not recap. (II-3)
9. Open flow-control clamp and adjust flow rate.
10. Document on appropriate format.

NOTE: If medicant is incompatible with primary solution, the port site being used on the primary line is flushed with normal saline before and after administration of medication.

B. Through a heparin lock

1. Wash hands.
2. Prepare syringes of heparin solution and N/S for flush.
3. Prepare medication port of heparin lock with antiseptic solution for one (1) minute.
4. Insert needle of syringe containing 1 ml normal saline into medication port.
5. Aspirate for blood backflow to verify cannula placement; flush

with 1 ml normal saline over 1 minute.

6. Inject medication at prescribed rate as timed by clock.
7. Remove needle from heparin lock while stabilizing the device.
8. Flush with 1 ml normal saline over 1 minute.
9. Instill 1 ml heparin flush solution over 1 minute.
10. Place syringes/needles in a puncture-proof container.
11. Document on appropriate format.

II. Summary and Conclusion

- A. Ask interaction items.
- B. Review steps of procedure.

LESSON PLAN: 8

COURSE TITLE: INTRAVENOUS FLUID THERAPY

UNIT VIII PHARMACOLOGICAL CONSIDERATIONS OF

INTRAVENOUS MEDICATION

INTERACTION ITEMS:

1. Why is the roller clamp closed on the primary line before injecting the medication through the port?
2. Why is it necessary to aspirate prior to injecting normal saline?
3. Why is it important not to recap needles?

CLASSROOM, LABORATORY, OR OTHER ACTIVITIES:

LESSON PLAN: 8

COURSE TITLE: INTRAVENOUS FLUID THERAPY

UNIT VIII PHARMACOLOGICAL CONSIDERATIONS OF
INTRAVENOUS MEDICATION

EVALUATION ITEMS: NAME OF STUDENT: _____

DRUG ADMINISTRATION VIA DIRECT INJECTION

EQUIPMENT:

1. Anatomical model with attached heparin lock or administration set
2. Syringe and needle with solution representing drug to be administered
3. Alcohol sponge
4. Watch or easily-read clock with sweep second hand
5. Syringes and needles with solution representing NS/heparin flush
6. Puncture-proof needle container

DID THE STUDENT:	YES	NO
<u>Inject Through a Primary Line with Compatible Solution</u>		
1. Wash hands.		
2. Cleanse lowest port of administration set with antiseptic solution over one (1) minute.		
3. Insert needle of medication syringe into port.		
4. Close roller clamp.		
5. Aspirate for blood backflow to verify placement.		
6. Inject medication at prescribed rate.		
7. Remove needle/syringe while grasping port.		
8. Place needle/syringe in puncture-proof container.		
9. Open flow control clamp and adjust flow rate.		
10. Document.		
<u>Inject Through a Heparin Lock</u>		
1. Wash hands.		
2. Prepare syringes of heparin flush solution and N/S for flush.		

DID THE STUDENT:	YES	NO
3. Prepare medication port of heparin lock with antiseptic solution for one (1) minute.		
4. Insert needle/syringe containing 1 ml NS into medication port.		
5. Aspirate for blood backflow to verify cannula placement; flush with 1 ml NS over 1 minute.		
6. Insert needle of medication syringe into medication port.		
7. Inject medication at prescribed rate.		
8. Remove needle/syringe from heparin lock while grasping lock.		
9. Place needle/syringe in puncture-proof container.		
10. Flush heparin lock with N/S over 1 minute.		
11. Instill 1 ml heparin solution flush over 1 minute.		
12. Document.		

The student has satisfactorily completed the procedure "DRUG ADMINISTRATION VIA DIRECT INJECTION" according to the steps outlined.

Instructor's/Charge Personnel's Signature
(Verifying Satisfactory Completion)

Date

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LESSON PLAN: 9
COURSE TITLE: INTRAVENOUS FLUID THERAPY
UNIT VIII PHARMACOLOGICAL CONSIDERATIONS OF
INTRAVENOUS MEDICATION

SCOPE OF UNIT:

This unit provides the practitioner with information regarding the basic principles of drug action as well as specific considerations associated with the safe and efficient delivery of intravenous drugs, including cytotoxic agents, administered by available intravenous routes.

INFORMATION TOPIC: X OR DEMONSTRATION:

MONITORING CHEMOTHERAPY
(Lesson Title)

LESSON OBJECTIVES - THE STUDENT WILL BE ABLE TO:

1. Identify basic concepts of chemotherapy.
2. Define the role of the LPN in chemotherapy.
3. Identify safety precautions when caring for patients receiving cytotoxic drugs.
4. List ten signs or symptoms of toxicity/side effects.
5. Name three nursing responsibilities to the chemotherapy patient.

SUPPLEMENTARY TEACHING/LEARNING ITEMS:

INFORMATIONAL ASSIGNMENT:

Plumer, Ada Lawrence. Principles and Practice of Intravenous Therapy. 4th ed. Boston: Little, Brown & Co., 1987.

Sager, Diane Proctor and Suzanne Kovarovic Bomar. Intravenous Medications: A Guide to Preparation, Administration and Nursing Management. Philadelphia: J. B. Lippincott Co., 1980.

Gahart, Betty L. Intravenous Medications - A Handbook for Nurses and Other Allied Health Personnel. St. Louis: C.V. Mosby Co., 1985.

REFERENCES:

Plumer, Ada Lawrence. Principles and Practice of Intravenous Therapy. 4th ed. Boston: Little Brown & Co., 1987.

Sager, Diane Proctor and Suzanne Kovarovic Bomar. Intravenous Medications: A Guide to Preparation, Administration and Nursing Management. Philadelphia: J. B. Lippincott Co., 1980.

Gahart, Betty L. Intravenous Medications - A Handbook for Nurses and Other Allied Health Personnel. St. Louis: C.V. Mosby, Co. 1985.

Brown, Mary H., et al. Standards of Oncology Nursing Practice. New York: John Wiley and Sons, 1986.

Guidelines For Cytotoxic (Antineoplastic) Drugs. OSHA Instruction PUB 8-1.1, Office of Occupational Medicine, U.S. Department of Labor, Washington, DC, Jan. 1986.

INTRODUCTION:

The use of cytotoxic drugs has been employed in the treatment of malignant disease over a period of approximately four decades. Active professional nursing involvement in chemotherapy administration barely encompasses 15 years. Although not legally allowed to administer cytotoxic drugs, the LPN can play a crucial role in the care of the oncology patient by monitoring the site and rate of infusion and by observing the patient for reactions and side effects. To perform these functions the LPN must have achieved an understanding and knowledge of the concept of chemotherapy.

LESSON PLAN: 9
COURSE TITLE: INTRAVENOUS FLUID THERAPY
UNIT VIII PHARMACOLOGICAL CONSIDERATIONS OF
INTRAVENOUS MEDICATION

OUTLINE: (Key Points)

- I. Basic Concepts
 - A. Chemotherapy - universally accepted term denoting treatment of cancer with cytotoxic drugs
 - B. Chemotherapy regimes
 1. Single cytotoxic drug
 2. Combination of drugs
 - C. May be used in conjunction with other treatment modalities
 1. Radiation
 2. Surgery
 - D. Action of cytotoxic drugs
 1. Destroy malignant cells by interfering with cell division and growth
 2. Are cell-cycle-stage specific or cell-cycle-stage nonspecific
 3. Also destroy some normal cells (usually rapidly reproducing ones)
 - E. Five (5) major classifications of cytotoxic drugs
 1. Alkylating agents
 2. Antimetabolites
 3. Antitumor antibiotics
 4. Steroids, hormones
 5. Plant alkaloids
 - F. Subclassifications
 1. Vesicants - capable of causing blistering and/or tissue necrosis

2. Irritants - capable of producing venous pain at site or along vein, with or without an inflammatory reaction

II. Informed Consent

- A. Physician obtains informed consent for treatment.
- B. Nurse provides supplemental information.
- C. Signed consent should become part of patient's permanent medical record.
- D. Additional questions/concerns should be directed to the attention of the physician.

III. Scope of Responsibility for Administration of Intravenous Cytotoxic Drugs (II-1)

- A. Only adequately prepared registered professional nurses who are skilled in administering chemotherapy should assume responsibility for its administration.
- B. Legally, the LPN is not allowed to administer chemotherapy.

IV. Toxicity/Side Effects (II-2)

A. Hematologic - dose-limiting factor

1. Decreased WBC

- a. Nadir - point at which WBC is at its lowest
- b. Normal nadir - 7-14 days, dependent upon drug
- c. Clinically significant - when neutrophil count is < 1000
- d. Usually dose adjustment or treatment delay - < 3000

2. Decreased platelets

- a. Increased risk for bleeding
- b. Usually dose adjustment or treatment delay - $< 100,000$
- c. Normally not transfused unless - $< 20,000$ or actively bleeding

3. RBC

- a. Last cells to decrease during chemotherapy
- b. Live much longer in peripheral blood than other cells

4. Hemoglobin
 - a. Patients receiving cytotoxic drugs are usually anemic with a Hgb around 10
 - b. Normally not transfused unless - 8 or $\leq$ or symptomatic
- B. Gastrointestinal
 1. Nausea and vomiting
 - a. Degree of severity and occurrence has been alleviated somewhat with antiemetic administration pretreatment
 - b. Rest, privacy, and positive state of mind affect occurrence
 2. Diarrhea
 3. Constipation: especially with pediatric patient receiving vincristine
 4. Stomatitis
 - a. Common with five-day, 5-FU regime
 - b. Often develops after discharge from hospital
- C. Dermatological - alopecia
 1. Dependent upon drug and dose
 2. With exception of Adriamycin - few drugs cause complete hair loss
 3. Caution: Never guarantee that hypothermia caps are 100% effective.
- D. Hyperpigmentation
 1. Most common with 5-FU
 2. Results in brownish streaks along venous network
 3. Sun exposure has a direct effect
- E. Radiation recall
 1. Area radiated appears sunburned
 2. Rarely occurs after 30 days when receiving Adriamycin
 3. Frequently occurs after long delay when receiving actinomycin

F. Hypersensitivity

1. Anaphylaxis - test dose should be given with high risk drugs
2. Flu-like symptoms
 - a. Often associated with bleomycin
 - b. Fever - 102-103°
 - c. One time fever spike
 - d. Hard chills

G. Cardiac

1. Have baseline cardiac studies
2. Monitor for clinical manifestations of CHF.
3. Cumulative dose of applicable drugs must be monitored.

H. Pulmonary

1. Have baseline pulmonary function
2. Close monitoring for alterations in pulmonary system functioning

I. Neurological

1. Particular risk with vincristine
2. Numbness in fingers - usually first sign
3. Numbness in toes and jaw
4. Slapping gait
5. Decreased or absent deep tendon reflexes
6. Requires alteration in dosing or stoppage of drug
7. Usually reversible over period of time

J. Hepatic

1. Liver function must be monitored
2. Observe signs of hepatotoxicity.
3. May require dose adjustment

K. Renal

1. Need baseline renal function
2. Periodic monitoring of renal function is a must.
3. Provide good hydration.

L. Hyperuricemia

1. Lymphoma and leukemia patients are extremely susceptible.
2. Monitor serum/urine level.
3. Encourage fluid intake.
4. Monitor I&O
5. Allopurinol may be an appropriate preventive measure.

M. Hemorrhagic cystitis

1. More common with oral cytoxan
2. Encourage fluid intake
3. Encourage frequent voiding
4. Observe urine for color change.

NOTE: Some drugs may affect color.

N. Ototoxicity

1. First sign - tinnitus
2. Loss of hearing could result from continued treatment.

V. Nursing Responsibilities

- A. Monitor for clinical manifestations indicative of toxicity.
- B. Provide appropriate interventions to alleviate discomfort arising from toxicity/side effects.
- C. Provide appropriate interventions to alleviate psychological distress associated with chemotherapy.
 1. Encourage patient and family to express their feelings.
 2. Provide information about the disease, treatment and side effects at the patient's level of understanding.
- D. Alert patient to observe and immediately report adverse reactions.

VI. Safety Precautions

- A. Waste disposal - all equipment and unused drugs should be treated as hazardous waste and disposed of according to the facility's policy and procedure
- B. Caring for Patients Receiving Cytotoxic Drugs
 - 1. Personal protective equipment - personnel dealing with blood, vomitus or excreta from patients who have received cytotoxic drugs in last 48 hours:
 - a. Should wear surgical latex gloves and a disposable gown.
 - b. Hands should be washed after removal of gloves or after contact with the above substances.
 - 2. Linen contaminated with cytotoxic drugs, blood, vomitus, or excreta should be:
 - a. Placed in a specially marked laundry bag which is then placed in a labeled impervious bag.
 - b. The above bag should be prewashed and then added to other laundry for an additional wash.
- C. Spills - should be cleaned up immediately by a properly protected person trained in appropriate procedures
- D. Personnel contamination:
 - 1. Contamination of gloves or gowns - immediate removal
 - 2. Direct skin or eye contact
 - a. Wash affected skin area immediately with soap (not germicidal cleaner) and water.
 - b. For eye exposure, immediately flood the affected eye with water or isotonic eyewash designated for that purpose for at least five minutes.
 - c. Obtain medical attention immediately.

VII. Summary and Conclusion

- A. Basic concept
- B. Informed consent
- C. Scope of responsibility for administration of intravenous cytotoxic drugs

- D. Toxicity/side effects
- E. Nursing responsibilities
- F. Safety precautions

LESSON PLAN: 9
COURSE TITLE: INTRAVENOUS FLUID THERAPY
UNIT VIII PHARMACOLOGICAL CONSIDERATIONS OF
INTRAVENOUS MEDICATION

INTERACTION ITEMS:

1. Why should the LPN be familiar with chemotherapy if not allowed to administer it?
2. Why should the LPN working with chemotherapy patients be aware of normal lab values and the patient's lab values?

CLASSROOM, LABORATORY, OR OTHER ACTIVITIES:

LESSON PLAN: 9
COURSE TITLE: INTRAVENOUS FLUID THERAPY
UNIT VIII PHARMACOLOGICAL CONSIDERATIONS OF
INTRAVENOUS MEDICATION

EVALUATION ITEMS:

For each of the following write "T" if the statement is true, or "F" if it is false.

- ☐ 1. Chemotherapy should not be done in conjunction with radiation.
- ☐ 2. Chemotherapy destroys only malignant cells.
- ☐ 3. Vesicants are capable of causing a blister and/or tissue necrosis.
- ☐ 4. If an irritant is producing venous pain along the vein, it will always be accompanied with an inflammatory reaction.
- ☐ 5. Signed consent form should be obtained by the physician and becomes part of patient's permanent medical record.
- ☐ 6. Legally, the LPN is not allowed to administer chemotherapy.
- ☐ 7. Careful hand washing only is required if dealing with blood, vomitus or excreta from patients who have received cytotoxic drugs in last 48 hours.
- ☐ 8. Wash direct-contaminated skin area immediately with germacidal cleaner.
- 9. List ten signs or symptoms of toxicity.
 - a.
 - b.
 - c.
 - d.
 - e.
 - f.
 - g.
 - h.
 - i.
 - j.

10. Name three nursing responsibilities to the chemotherapy patient.

a.

b.

c.

500

LESSON PLAN: 10
COURSE TITLE: INTRAVENOUS FLUID THERAPY
UNIT VIII PHARMACOLOGICAL CONSIDERATIONS OF
INTRAVENOUS MEDICATION

ANSWERS TO EVALUATION ITEMS:

1. F
 2. F
 3. T
 4. F
 5. T
 6. T
 7. F
 8. F
9. The student may list any ten of the following:
- a. Decreased WBC
 - b. Decreased platelets
 - c. Anemia
 - d. Nausea and vomiting
 - e. Diarrhea
 - f. Constipation
 - g. Stomatitis
 - h. Alopecia
 - i. Hyperpigmentation
 - j. Radiation recall
 - k. Anaphylaxis
 - l. CHF manifestations
 - m. Numbness of fingers
 - n. Numbness of toes and jaw
 - o. Slapping gait
 - p. Decreased or absent deep tendon reflexes
 - q. Hepatotoxicity
 - r. Hyperuricemia
 - s. Hemorrhagic cystitis
 - t. Tinnitus
10. The student may list any three of the following:
- a. Monitor for toxicity
 - b. Alleviate discomfort from toxicity/side effects
 - c. Alleviate psychological distress
 - d. Patient teaching

LESSON PLAN: I

COURSE TITLE: INTRAVENOUS FLUID THERAPY

UNIT IX BLOOD TRANSFUSION THERAPY

SCOPE OF UNIT:

This unit introduces participants to the principles of basic immunohematology and the proper handling of blood components. The introduction of the principles associated with the potential adverse reactions to blood transfusions will enable the student to effectively monitor blood transfusion patients within the scope of the Missouri Nursing Practice Act and the protocol of the parent institution.

INFORMATION TOPIC: X

OR

DEMONSTRATION:

TRANSFUSION THERAPY
(Lesson Title)

LESSON OBJECTIVES - THE STUDENT WILL BE ABLE TO:

1. Name the ABO blood type that is considered the universal donor.
2. Name three objectives of transfusion therapy.
3. State the only parenteral solution that is appropriate to initiate/facilitate the delivery of blood/blood components.
4. Define the role of the LPN in blood transfusion administration.
5. Identify principles of blood administration.

SUPPLEMENTARY TEACHING/LEARNING ITEMS:

1. Exhibit of examples of blood administration sets
2. HO 1: ABO Compatible Blood Products

INFORMATIONAL ASSIGNMENT:

Plumer, Ada Lawrence. Principles and Practice of Intravenous Therapy. 4th ed. Boston: Little, Brown & Co., 1987.

REFERENCES:

Plumer, Ada Lawrence. Principles and Practice of Intravenous Therapy. 4th ed. Boston: Little, Brown & Co., 1987.

American Association of Blood Bank, Safe Transfusion. Presented by The Committee on Technical Workshops, Chicago, IL, 1981.

Putman, Roanne C. and William V. Miller. Transfusion Therapy: Principles and Procedures, 2nd ed. Maryland: Aspen Systems Corporation.

Pauley, Susan Y. "Transfusion Therapy for Nurses - Part I," Journal of the National Intravenous Therapy Association (NITA) 7 (1984): 501-511.

INTRODUCTION:

With the increasing use of blood and its components, transfusion therapy has become an integral part of patient treatment. The role of responsibility for administration is delegated to the RN. Although not allowed to initiate blood transfusion therapy, the LPN with an understanding of blood systems, blood components, and the principles of transfusion therapy can provide efficient and safe monitoring of the patient during ordered therapy.

LESSON PLAN: I
 COURSE TITLE: INTRAVENOUS FLUID THERAPY
 UNIT IX BLOOD TRANSFUSION THERAPY

OUTLINE: (Key Points)

- I. Basic Immunohematology
 - A. Immunohematology - the science that deals with antigens of the blood and their antibodies
 - B. Antigen
 1. Substance capable of stimulating the production of an antibody and then reacting with that antibody in a specific way
 2. Are situated on the surface of red blood cells
 3. Genetically transmitted
 - C. Antibodies
 1. React with specific antigens
 2. Located in the plasma
- II. Most Common Human Blood Group Systems
 - A. Most common human blood group system
 1. ABO
 2. Rh
 - B. ABO system
 1. Discovered by Karl Landsteiner in 1901
 2. Classification of human blood based on antigens on the red cells and antibodies in the serum
 3. ABO Grouping: (HO I)

<u>Blood Group</u>	<u>Antigens on Red Cells</u>	<u>Antibodies in Serum</u>
O	No A or B antigens	Anti-A and Anti-B
A	A	Anti-B
B	B	Anti-A
AB	A and B	None

4. Type O - considered universal donor

C. Rhesus (Rh) system

1. Discovered by Landsteiner and Wiener in 1940
2. Name comes from relationship to the substance in the red cells of the rhesus monkey
3. Antigens belonging to Rh system are C, D, E, c, and e.
4. Antibody D is built up with ease in the body, so typing is done to ensure D-negative recipients receive D-negative blood.
5. Blood containing D antigen - Rh positive
6. Blood lacking D antigen - Rh negative

III. Objectives of Transfusion Therapy

- A. Maintenance of blood volume
- B. Maintenance of oxygen-carrying capacity of the blood by supplying red blood cells
- C. Maintenance of coagulation properties by supplying clotting factors found in platelets and plasma

IV. Blood Preservatives

- A. Purpose - to prevent coagulation
- B. Available types and time span
 1. ACD - 21 days
 2. CPD - 21 days
 3. CPDA - 1-35 Days
 4. ADSOL - 49 days (red cells only)

V. Blood Products

- A. Whole blood
 1. Indications
 - a. Acute massive blood loss
 - b. Exchange transfusion in newborn
 - c. Cardiac surgery
 2. Must be ABO compatible

3. Primary disadvantages

- a. During storage, potassium leaks from the cells into the plasma.
- b. Supply is limited.
- c. Massive transfusion may be accompanied by citrate toxicity.

B. Packed red cells

1. Prepared by the removal of 70-80% of the plasma

2. Indications for use

- a. To restore or maintain oxygen-carrying capacity
- b. Chronic anemia (when unable to treat pharmacologically)
- c. Surgical loss

3. Must be ABO compatible

4. Advantages

- a. Reduced volume
- b. Reduced chemical content
- c. Reduced agglutinens

C. Frozen red cells

1. Plasma is removed, cells are coated with glycerol and frozen to keep cells intact - glycerol is removed before transfusion

2. Indications for use

- a. Same as with packed red cells
- b. Provision of rare blood types
- c. Patients with history of nonhemolytic transfusion reactions
- d. Patients who are IgA deficient with anti-IgA antibodies
- e. Autologous transfusion

3. Advantages

- a. Decreased content of plasma, platelets and leukocytes
- b. Use for autologous transfusions
- c. Long storage life - three years

4. Must be ABO compatible
5. Must be transfused within 24 hours of thawing

D. Leukocyte-poor washed red blood cells

1. At least 75% of the original leukocytes in the blood product were removed.
2. Indications for use
 - a. Patients who have repeated or severe febrile transfusion reactions
 - b. Same as packed red cells
3. Must be ABO compatible
4. Use within 24 hours of preparation

E. Fresh frozen plasma

1. Plasma separated by centrifugation from whole blood
2. Contains most clotting factors
3. Indications for use
 - a. Massive transfusion - with bleeding secondary to coagulation factor deficiencies
 - b. Massive hemorrhage - hypovolemia with coagulation factor deficiencies
 - c. Specific coagulation factor deficiencies - factors V, XIII and XI
 - d. Shock - acute hemorrhage, plasma loss, burns (albumin preferred)
 - e. Reverse excessive anticoagulant therapy
 - f. Liver disease with bleeding complications
4. Compatibility

DONOR GROUP

A, AB
B, AB
AB
O

RECIPIENT

A
B
AB
O, AB, A, B

5. Use within two (2) hours of thawing.

F. Platelets

1. Platelet concentrates are prepared by separating platelet-rich plasma from a unit of whole blood within six (6) hours after collection. The platelet-rich plasma is then centrifuged and the supernatant platelet-poor plasma is expressed into a third satellite bag.
2. Two available preparations:
 - a. Random-donor concentrates - made from separate individual donors
 - b. Single-donor concentrates - taken from the same donor by plateletpheresis
3. Indications for use
 - a. Thrombocytopenia due to:
 - (1) Abnormally functioning platelets
 - (2) Aplastic anemia
 - (3) Chemotherapy
 - (4) Rapid dilution of platelets by resuscitation fluids and stored whole blood
 - (5) Drug reactions - being secondary to disseminated intravascular coagulation (DIC)
 - b. Idiopathic thrombocytopenia purpura (ITP)
4. ABO compatibility not essential
5. Rh preferred but not necessary
6. Usually not given unless count $< 20,000$
7. Special component drip set - specific platelet filter
8. Storage period - 72 hours at room temperature; five (5) days after collection with special "breathable" bag

G. Cryoprecipitate

1. Single-donor concentrated factor VIII made from cold-thawed plasma

2. Indications for use
 - a. Hemophilia A
 - b. von Willebrand's disease
 - c. Hypofibrinogenemia
3. Provides factor VIII and fibrinogen
4. ABO-Rh compatible when possible
5. Storage life - one (1) year frozen
6. Use within six (6) hours of thawing.

VI. Plasma Derivatives

A. 5% normal serum albumin

1. Prepared by fractionation of pooled plasma
2. Commercially available
3. Available in 250 ml and 500 ml of saline
4. Is an isotonic solution
5. Indications for use
 - a. Restoring or maintaining blood volume
 - b. Emergency treatment of shock owing to acute blood loss after trauma or surgery
 - c. Useful for plasma replacement in treating hypovolemic shock caused by severe burns when there is loss of plasma fluids but not red cells.
6. Crossmatching not necessary
7. Administration set provided
8. No hepatitis risk

B. 25% normal serum albumin

1. Prepared same as 5% normal serum albumin
2. Commercially available
3. Supplied in units of 50 ml and 100 ml of saline
4. Is a hypertonic solution

5. Indications for use
 - a. Plasma volume expander
 - b. Treatment of hypovolemic shock
 - c. In treatment of burn patient to maintain adequate plasma volume along with protein colloid levels
6. Recommended rate of infusion
 - a. No greater than 2-3 ml/minute
 - b. Too-rapid infusion could result in:
 - (1) Circulatory overload
 - (2) Pulmonary edema
 - (3) Increased interstitial dehydration
7. Crossmatching not necessary
8. Administration set provided
9. No hepatitis risk
- C. Plasma protein fraction (PPF)
 1. Contains 83% albumin and 17% alpha and beta globulins
 2. Shares same clinical uses as 5% normal serum albumin
 3. Hypotensive episodes have been documented with rapid infusions
 4. Often used as a volume expander while crossmatching is being completed
 5. No crossmatching necessary
 6. No hepatitis risk
- D. Factor IX complex
 1. Lyophilized preparation obtained from pooled plasma
 2. Contains factors II, VII, IX and X plus a minimal amount of other proteins
 3. Major use - arrest serious hemorrhage in patients with hemophilia B (Christmas disease)

4. ABO-Rh crossmatching unnecessary
5. Not subjected to any treatment to diminish risk of transmitting hepatitis - must weigh risk/benefit ratio

E. White blood cells (granulocytes)

1. Obtained by leukapheresis
2. Are suspended in 300-500 ml of plasma
3. Infrequently administered
4. Indicated in patients in neutropenic states who are unresponsive to antibiotics for 24-48 hours - fever with $10/\text{mm}$ of granulocytes and have been unresponsive to treatment for septicemia
5. ABO-Rh crossmatching required
6. Close HLA (Human Leukocyte Antigen) match ideal
7. Adverse reaction is expected.
 - a. Temperature - $101-102^{\circ}$
 - b. Chills
 - c. Occasionally urticaria
 - (1) Treat with morphine, Tylenol, Benedryl.
 - (2) Discontinue if chest pain and/or shortness of breath (SOB) occurs.
8. Should be transfused within 24 hours of donation

VII. Principles of Blood Administration

- A. Role of responsibility - state of Missouri (II-2)
 1. Obtaining unit from blood bank - dependent upon individual agency's policy
 2. Crosschecking of identifying data pre-initiation of transfusion - dependent upon individual agency's policy
 3. Initiation of transfusion - registered professional nurse (RN)
 4. Monitoring during transfusion - RN and/or LPN
- B. Physician order
 1. Blood component to be transfused
 2. Number of units to be transfused

3. May include other specifics
 - a. Use of a blood warmer
 - b. Microaggregate filtration
 4. Could denote unusual time span for administration
 - a. Rapid
 - b. Slow
- C. Issue and transfer
1. Blood transfusion requisition - mandatory
 2. Mode of transfer of blood components to the ward - depends upon hospital policy
 3. Only one (1) unit should be transported by a person at a time.
 4. Should be visually examined prior to removal from blood bank for evidence of:
 - a. Unusual color
 - b. Clotting
 - c. Presence of air bubbles
 - d. Other evidence of contamination
- D. Patient - blood identification
1. Absolute and positive identification of the donor blood and the patient recipient is mandatory.
 2. Final crosschecking of identifying data should be done at the patient's bedside by two (2) people and should correspond on blood unit, blood tag, and patient identification.
 - a. ABO and Rh compatibility
 - b. Blood identification number
 - c. Expiration date
 3. Patient identification
 - a. Check name and unit number on blood tag with the face sheet in patient's chart.
 - b. Ask patient to identify himself or herself by complete name.

- c. Hospital numbers on identification bracelet must correspond with numbers on blood tag.
- d. Any discrepancy must be investigated and appropriately corrected before initiation of the transfusion.
- e. Blood should never be administered to a patient lacking an identification bracelet.

E. Handling blood

- 1. To prevent excessive warming, blood should be administered within 30 minutes of the time it leaves the blood bank.
- 2. Blood should never be placed in ward refrigerators.
- 3. If the 30 minute time limit cannot be met, the unit of blood must be returned to the blood bank.

F. Baseline vital signs (II-3)

- 1. Vital signs should always be taken prior to initiation of a transfusion.
- 2. If temperature is one (1) degree Centigrade (1.8 degree Fahrenheit) above the patient's normal temperature, the physician should be notified prior to initiation of transfusion.

G. Primary starter solution (II-4)

- 1. Normal saline (N/S) is the only solution that may be used to initiate a transfusion.
- 2. The addition of 50-100 ml N/S to a unit of packed red cells will greatly enhance ease of flow.
- 3. The amount of starter solution infused should be included in intake calculations.

H. Medication should never be added to blood or administered simultaneously through the same set (N/S is not considered a medication).

I. Filtration

- 1. Sterile pyrogen-free filter of 170 microns used with most components
- 2. Microaggregate filter of 20-40 microns often ordered for:
 - a. Patients with compromised pulmonary function
 - b. Total replacement (in 24 hours)
 - c. Patients with a history of febrile reactions

J. Venipuncture/cannula selection

1. Large vein indicated - to ensure flow of viscous components
2. Lower extremities and areas of joint flexion should be avoided.
3. 18 gauge catheter is preferred but often a 20 gauge catheter is indicated due to size of available veins.
4. 19 gauge winged infusion sets are often used for adult patients.
5. A 23 gauge thin-walled small-vein set is often used for pediatric patients, but:
 - a. Flow rate will be diminished
 - b. Any application of external pressure to the blood bag may damage the cells

K. Rate of transfusion

1. Governed by clinical condition of patient and component being transfused
2. Most patients can tolerate infusion of one (1) unit red cells in 1½ -2 hours.
3. Longer period of time indicated - patients in congestive failure or in danger fluid overload
4. Danger of bacterial proliferation and red cell hemolysis in blood kept at room temperature longer than four (4) hours
5. When unit is ordered to infuse > 4 hours, blood may be separated into aliquots and portion stored in blood bank while one portion is being transfused

L. Monitoring patient

1. After the transfusion is initiated, the nurse should observe the patient during initial 5-30 minutes of the infusion (time span dependent upon individual agency's policy).
2. Vital signs should be monitored at appropriate intervals during transfusion (times are dependent upon individual agency's policy).
3. Patient should be kept warm during transfusion.
4. Patient should be checked frequently during a transfusion for signs and symptoms indicative of a developing transfusion reaction.
 - a. Elevated temperature
 - b. Chills

- c. Headache
- d. Hypotension or hypertension
- e. Lumbar pain
- f. Nausea and vomiting
- g. Difficulty breathing
- h. Hives
- i. Erythema
- j. Itching
- k. Flushing

M. Blood warmers

- 1. Only commercially-available blood warmers are to be used.
- 2. The use of "makeshift" warm water baths is strictly prohibited.

N. Miscellaneous

- 1. Accurate documentation of all information pertinent to a blood transfusion is to be inscribed on the designated blood transfusion form/requisition and in appropriate sections of the patient's chart, thus becoming a part of the patient's permanent medical record.
- 2. Patients are not to be scheduled for diagnostic tests or therapy necessitating transportation to ancillary departments during a transfusion. In the event the patient's clinical condition mandates such testing, he/she must be accompanied to the testing area by a nurse who is to remain in attendance during the test.
- 3. The volume of whole blood or blood component transfused is to be included in "intake" calculations.

VIII. Summary and Conclusion

- A. Basic immunohematology
- B. Most common human blood group systems
- C. Objectives of transfusion therapy
- D. Blood preservatives
- E. Blood products
- F. Plasma derivatives
- G. Principles of blood administration

LESSON PLAN: 1

COURSE TITLE: INTRAVENOUS FLUID THERAPY

UNIT IX BLOOD TRANSFUSION THERAPY

INTERACTION ITEMS:

1. Why is it necessary to have an understanding of the ABO/Rh blood group systems?
2. What is the role of the LPN in monitoring blood transfusions?
3. Why should baseline vital signs be obtained pre-blood transfusion?
4. Why is N/S the only IV solution that can be used to initiate blood transfusions?

CLASSROOM, LABORATORY, OR OTHER ACTIVITIES:

1. Practice initiating IV with N/S and blood administration set.
2. Practice changing administration set after blood transfusion has been completed.

LESSON PLAN: 1

COURSE TITLE: INTRAVENOUS FLUID THERAPY

UNIT IX BLOOD TRANSFUSION THERAPY

EVALUATION ITEMS:

1. Name the ABO blood type that is considered the universal donor.
2. Name three objectives of transfusion therapy.
 - a.
 - b.
 - c.
3. Name the only parenteral solution that is appropriate to initiate/facilitate the delivery of blood/blood components.

For each of the following, write "T" if the statement is true, or "F" if it is false.

- ☐ 4. The Missouri state law clearly defines the specific method of obtaining blood from the blood bank and crosschecking procedures that all institutions must adhere to.
- ☐ 5. The LPN who has successfully completed a Missouri state-approved IV therapy course may initiate a transfusion.
- ☐ 6. An LPN may monitor a blood transfusion.
- ☐ 7. With a physician's order for the same, packed red cells can be given other than the usual 1½ -2 hours.
- ☐ 8. If more than one (1) unit of blood is to be given, both should be issued and transported to the ward at the same time.
- ☐ 9. Only the one RN administering the blood does the final crosscheck at the patient's bedside.
- ☐ 10. Blood must never be administered to a patient lacking an identification bracelet.
- ☐ 11. Blood can be administered up to one hour after leaving the blood bank.
- ☐ 12. Vital signs should always be taken prior to initiation of transfusion.
- ☐ 13. If temperature is 1° C (1.8° F) above patient's normal prior to initiation of transfusion, the physician should be notified.

- ___ 14. Adding N/S to a unit of packed red cells should not be done as it may damage the cells.
- ___ 15. Medications should be added via the lowest port of the blood administration set to avoid as short a contact as possible with the blood infusion.
- ___ 16. An 18-20 gauge cannula is preferred for blood infusion.
- ___ 17. The 23 gauge thin-walled small-vein set often used for pediatric patients will not affect the flow rate.
- ___ 18. Help keep the patient cool during infusion of blood as often she/he will become very warm.
- ___ 19. Elevated temperature, chills, headache, lumbar pain and/or itching could be indicative of a developing transfusion reaction.
- ___ 20. If blood is used directly from the blood bank refrigerator, it can be placed in warm water to bring it to an appropriate and safe infusion temperature.
- ___ 21. Patients are not to be scheduled for diagnostic tests or therapy necessitating transporting to another department during a transfusion.
- ___ 22. The volume of blood or blood components and starter solution are not included in "intake" calculations.

LESSON PLAN: I

COURSE TITLE: INTRAVENOUS FLUID THERAPY

UNIT IX BLOOD TRANSFUSION THERAPY

ANSWERS TO EVALUATION ITEMS:

1. Type O
2.
 - a. Maintenance of blood volume
 - b. Maintenance of oxygen-carrying capacity of blood by supplying RBC's
 - c. Maintenance of coagulation properties by supplying clotting factors found in platelets and plasma
3. Normal saline (N/S)
4. F
5. F
6. T
7. T
8. F
9. F
10. T
11. F
12. T
13. T
14. F
15. F
16. T
17. F
18. F
19. T
20. F
21. T
22. F

ABO Compatible Blood Products

PATIENT'S ABO GROUP	COMPATIBLE WHOLE BLOOD	COMPATIBLE RED BLOOD CELLS	COMPATIBLE PLASMA
O	O	O	O
A	A	A, O	A, AB
B	B	B, O	B, AB
AB	AB	AB, A, B, O	AB

LESSON PLAN: 2

COURSE TITLE: INTRAVENOUS FLUID THERAPY

UNIT IX BLOOD TRANSFUSION THERAPY

SCOPE OF UNIT:

This unit introduces participants to the principles of basic immunohematology and the proper handling of blood components. The introduction of the principles associated with the potential adverse reactions to blood transfusions will enable the student to effectively monitor blood transfusion patients within the scope of the Missouri Nursing Practice Act and the protocol of the parent institution.

INFORMATION TOPIC: X OR DEMONSTRATION:

ADVERSE EFFECTS OF BLOOD TRANSFUSION
(Lesson Title)

LESSON OBJECTIVES - THE STUDENT WILL BE ABLE TO:

1. Name the three classifications of adverse reactions to blood transfusion.
2. Identify the most acute and potentially devastating reaction.
3. State the time span in which delayed transfusion reactions may occur.
4. Name the cause of an intravascular hemolytic reaction.
5. List the most frequently encountered transfusion reactions.
6. List the four clinical signs and symptoms of an urticaria reaction.
7. List four nursing interventions relative to all suspected transfusion reactions.
8. Name the type of hepatitis most commonly resulting from blood transfusions.
9. State what year testing of donor blood for the presence of the HTLV-III antibody (AIDS) was begun.

SUPPLEMENTARY TEACHING/LEARNING ITEMS:

INFORMATIONAL ASSIGNMENT:

Plumer, Ada Lawrence. Principles and Practice of Intravenous Therapy. 4th ed. Boston: Little, Brown & Co., 1987, ch. 13.

REFERENCES:

Plumer, Ada Lawrence. Principles and Practice of Intravenous Therapy. 4th ed. Boston: Little, Brown & Co., 1987, ch. 13.

Putman, Roanne C. and William V. Miller. Transfusion Therapy: Principles and Procedures. 2nd ed. Maryland: Aspen Systems Corporation.

Pauley, Susan Y. "Transfusion Therapy for Nurses, Part 2," Journal of the National Intravenous Therapy Association (NITA) 8 (1985): 51-60.

INTRODUCTION:

Blood transfusion therapy has become an important treatment modality in today's modern medicine. Since there is probably no other biological product that carries with it the potential for dangerous and harmful consequences than blood, personnel associated with the administration of whole blood/blood components must be cognizant of the various adverse reactions and their accompanying signs and symptoms.

LESSON PLAN: 2
COURSE TITLE: INTRAVENOUS FLUID THERAPY
UNIT IX BLOOD TRANSFUSION THERAPY

OUTLINE: (Key Points)

- I. Classifications of Adverse Reactions to Blood Transfusion (II-1)
 - A. Endogenous reactions
 1. Those caused by antigen-antibody reactions in the recipient; direct result of the body's response to foreign protein
 2. Occur within 48 hours after initiation of the transfusion which may be construed as beneficial for the patient - since most patients are still hospitalized and are immediately accessible for observing, monitoring, and treatment
 - B. Exogenous reactions - those caused by external factors in the administration of blood; antigen-antibody reaction is absent
 - C. Delayed reactions - those that occur 48 hours to months after the transfusion and are the result of transmitted disease or isoimmunization
- II. Endogenous Reactions
 - A. Intravascular hemolytic reaction
 1. Most acute and potentially devastating of all reactions
 2. Virtually all fatal blood transfusion reactions are due to ABO blood group incompatibilities.
 3. During the intravascular hemolytic reaction process, the recipient's entire antibody load reacts with the donor red cells with resultant rapid destruction of red cells through hemolysis.
 4. Cause - intravascular hemolytic reactions are the direct result of human error
 - a. Improperly identified recipient blood sample used for typing/crossmatching
 - b. Crossmatch records exchanged in lab or mislabeled
 - c. Improperly identified blood unit
 - d. Improperly identified patient

5. Preventive Measures

- a. Proper patient identification is mandatory!
- b. Do not deviate from established, appropriate blood transfusion protocol.

6. Clinical signs and symptoms

- a. Burning sensation along vein being used
- b. Fever with or without chills
- c. A sense of impending doom
- d. Tightness in the chest
- e. Shortness of breath
- f. Lumbar and flank pain
- g. Hypotension
- h. Tachycardia
- i. Abnormal bleeding (wound and/or venipuncture site)
- j. Anuria
- k. Hemoglobinuria
- l. Oliguria
- m. Shock

7. Immediate nursing intervention

- a. Stop the transfusion. (II-2)
- b. KVO with N/S (if "Y"-tubing is being used, a new fluid setup should be connected directly to the cannula; do not open the flow to the N/S of the "Y" set - would result in the patient receiving the additional blood cells contained in the tubing.)
- c. Notify the physician.
- d. Notify blood bank.
- e. Monitor vital signs.
- f. Initiate approved blood transfusion reaction protocol.

8. Treatment goals

- a. Prevention of renal vasoconstriction which is the usual cause of death
 - (1) Rapid infusion of IV fluids
 - (2) Diuretics
 - (3) Maintain urinary flow rate of adult at or over 100 ml/hr for at least 18-24 hours
 - b. Management of shock - vasopressors
 - c. In severe reactions with prolonged renal failure - dialysis
9. Outcome - the extent of acuity and the mortality of an intravascular hemolytic reaction is proportional to the amount of incompatible blood transfused
- B. Febrile non-hemolytic reaction
- 1. Type most frequently encountered
 - 2. Occurs in 1-2% of transfusions administered
 - 3. Process - recipient's antibodies reacting with transfused lymphocytes or platelet cell membranes
 - 4. Predisposing factors
 - a. Patients who have been sensitized to platelet and plasma proteins by numerous transfusions
 - b. History of multiple pregnancies
 - 5. Clinical signs and symptoms (seldom occur earlier than one hour after initiation of transfusion and may even occur after the transfusion has completed)
 - a. Flushing of face
 - b. Mild to severe fever
 - c. Chills
 - d. Lumbar pain
 - e. Palpitations
 - f. Headache
 - g. Malaise
 - h. Hypotension

6. Nursing intervention
 - a. Stop the transfusion
 - b. KVO with NS with a new fluid set connected to the cannula
 - c. Notify physician
 - d. Notify blood bank
7. Treatment
 - a. Usually symptomatic (antipyretics)
 - b. Physician may order continuation of transfusion after administration of antipyretics if reaction is mild.
8. Prevention with subsequent transfusions
 - a. Subsequent transfusions should consist of those blood components that are:
 - (1) Deglycerolized red cells
 - (2) Leukocyte-poor red blood cells
 - (3) Washed red cells
 - b. Microaggregate blood filtration should be utilized.

C. Urticaria reaction

1. Occurs with about same frequency as non-hemolytic febrile reactions
2. Cause - essentially unknown but thought to be result of transfer of allergen in donor blood or plasma to recipient
3. Clinical signs and symptoms
 - a. Local erythema
 - b. Hives
 - c. Itching
 - d. Possibly fever
4. Nursing intervention
 - a. If no fever - stop flow of blood; KVO with N/S
 - b. If fever is present - stop transfusion; KVO with N/S with a new fluid set connected to the cannula.
 - c. Notify the physician

5. Treatment

- a. Relief of symptoms with antihistamines
- b. Provision of comfort measures
- c. Transfusion is often ordered continued after administration of antihistamines.

D. Anaphylactic reactions

- 1. Are rare but dramatic--can result in death unless recognized and treated promptly
- 2. Distinctive features
 - a. Occurs after the infusion of only a few ml of blood or plasma
 - b. Absence of fever
- 3. Clinical signs and symptoms
 - a. Coughing
 - b. Respiratory distress
 - c. Hypotension
 - d. Abdominal cramping
 - e. Diarrhea
 - f. Vomiting
 - g. Shock
 - h. Coma
- 4. Death can occur if not treated promptly
- 5. Nursing intervention
 - a. Stop transfusion.
 - b. KVO with NS with a new fluid set connected to the cannula.
 - c. Notify physician STAT!
- 6. Treatment - corresponds to treating drug anaphylaxis
 - a. Maintenance of a patient airway
 - b. Vasopressors

- c. Oxygen
- d. Steroids
- e. Parenteral fluids

III. Exogenous Reactions

A. Bacterial contamination

1. Rare, but can be fatal if it occurs; onset is rapid
2. Cause - contamination occurring
 - a. At time of donation
 - b. During component preparation
 - c. As a result of improper storing
3. Deterrent - visually examine blood prior to administration for causes of rejection
 - a. Purple color
 - b. Presence of clots and/or gas bubbles
4. Clinical signs and symptoms
 - a. High fever
 - b. Increased pulse rate
 - c. Hypotension
 - d. Flushing of skin
 - e. Hemoglobinuria
 - f. Renal failure
 - g. Disseminated intravascular coagulation (DIC)
5. Nursing intervention
 - a. Stop the transfusion.
 - b. KVO with N/S with a new fluid set connected to the cannula
 - c. Aseptically preserve the suspected component container and attached administration set for return to blood bank for follow-up investigation.

- d. Notify the physician STAT!
- e. Notify the blood bank.
- 6. Treatment - symptomatic
 - a. Vasopressors
 - b. Steroids
 - c. Parenteral fluids
 - d. Antibiotics

B. Circulatory overload

- 1. Result of decompensated patient being transfused too rapidly or the transfusion of large volumes of whole blood/plasma to patient with normal blood volume
- 2. Deterrent
 - a. Evaluation of cardiac and pulmonary status pre-transfusion
 - b. Close monitoring during transfusion
 - c. Transfusion of packed red blood cells instead of whole blood
- 3. Clinical signs and symptoms
 - a. Severe pounding headache
 - b. Cyanosis
 - c. Dyspnea
 - d. Increased systolic blood pressure
 - e. Increased central venous pressure
- 4. Nursing intervention
 - a. Discontinue transfusion.
 - b. KVO at a markedly slow rate of infusion.
 - c. Place in a sitting position to facilitate breathing.
 - d. Notify physician STAT!
- 5. Treatment - goal is to reverse symptoms
 - a. Oxygen

- b. Diuretics
- c. Phlebotomy, if severe

C. Air embolism

1. Result of large amounts of air entering the blood stream
2. May result in fatality!
3. Infrequent since advent of closed system plastic containers
4. Cause - faulty administration technique (II-3)
 - a. Infusion of blood components under pressure with an open system
 - b. Allowing air to enter system when changing bags
 - c. Failure to expel air from tubing pre-initiation of transfusion
5. Clinical signs and symptoms
 - a. Sudden coughing
 - b. Dyspnea
 - c. Hypotension
 - d. Cyanosis
 - e. Convulsions
 - f. Shock
 - g. Cardiac arrest
6. Nursing intervention
 - a. Stop source of air immediately.
 - b. Place patient on left side in Trendelenberg position.
 - c. Notify physician STAT!
 - d. 100% oxygen
7. Treatment
 - a. Manage shock
 - b. Possible cardiocentesis

D. Hypothermia

1. Result of rapid administration of cold blood/blood components
2. Degree of severity is dependent on rate and amount infused and patient's tolerance of hypothermia
3. Clinical signs and symptoms
 - a. Shaking chills
 - b. Hypotension
 - c. Cardiac arrhythmias
 - d. Possible metabolic changes
 - e. Cardiac arrest
4. Nursing intervention
 - a. Stop transfusion.
 - b. KVO with N/S.
 - c. Provide warmth measures.
 - d. Notify physician STAT!
 - e. Obtain order for EKG.
5. Treatment - goal is to reverse hypothermia via warmth measures
6. Preventive measures
 - a. Use of automatic blood warmer
 - (1) During rapid transfusion therapy
 - (2) During massive replacement therapy

E. Citrate toxicity

1. Rare reaction occurring when citrate anticoagulant accumulates in patients with hypothermia or severely impaired liver function and during rapid transfusion therapy
2. Process - citrate ions combine with the recipient's calcium and could result in fatality due to cardiac dysfunction related to the hypocalcemia

3. Clinical signs and symptoms
 - a. Circumoral tingling
 - b. Tingling of fingers
 - c. Hypotension
 - d. Nausea and vomiting
 - e. Muscular cramps
 - f. Convulsions
 - g. Cardiac arrhythmias
4. Nursing intervention
 - a. Slow or stop the transfusion
 - b. Notify physician STAT!
5. Treatment - slow IV administration of ionized calcium

IV. Delayed Reactions

A. Delayed hemolytic reaction

1. Is usually the result of the patient having been sensitized to foreign red blood cell antigens not in the ABO system
2. May occur days to months after a transfusion
3. Predisposing factors
 - a. History of previous transfusion
 - b. History of pregnancy
4. Clinical signs and symptoms
 - a. Continued anemia
 - b. Decreased hemoglobin level
 - c. Positive direct antiglobulin test
 - d. Hemoglobinuria (depending on severity)

- e. Mild jaundice
- f. Bilirubinuria

NOTE: Future transfusions should be administered with components lacking the corresponding antigen.

B. Hepatitis

1. Occurs in about 7% of transfused patients
2. Types
 - a. Usually hepatitis B or non-A, non-B hepatitis
 - b. Hepatitis-A is rarely, if ever, the result of transfusions.
3. Time span - may appear 2 weeks to 6 months after transfusion
4. Clinical signs and symptoms (dependent upon severity)
 - a. Abnormal liver function tests
 - b. Elevated liver enzymes
 - c. Weakness
 - d. Fatigue
 - e. Nausea
 - g. Cigarette aversion
5. Treatment is symptomatic
 - a. Encourage rest
 - b. High protein, high caloric diet

C. Syphilis

1. Transfusion-acquired syphilis has been nearly eradicated due to
 - a. Required FDA serological testing
 - b. Improvements in refrigerated storage
2. Greatest risk - fresh whole blood carries the greatest risk of transfusion-transmitted syphilis

- D. Malaria - transfusion-acquired malaria has been virtually eradicated through pre-screening of donors

E. Acquired Immune Deficiency Syndrome (AIDS)

1. Human T-cell lymphotropic virus destroys the body's immune system
2. Clinical signs and symptoms - deterioration of immune system manifested by:
 - a. Fever
 - b. Night sweats
 - c. Weight loss
 - d. Adenopathy
 - e. Skin lesions (Kaposi's Sarcoma)
 - f. Pneumocystic pneumonia
3. Treatment
 - a. Treatment has been essentially to treat the opportunistic infections and/or carcinomas.
 - b. Azidothymidine (AZT) therapy in limited cases became available on an experimental basis in late 1986 - FDA approval March 20, 1987
4. Outcome - death
5. Testing of blood donors - test for HTLV-III antibody became available in March, 1985 to screen blood donors

V. Summary and Conclusion

- A. Classifications of adverse reactions to blood transfusion
- B. Endogenous reactions
- C. Exogenous reactions
- D. Delayed reactions

LESSON PLAN: 2

COURSE TITLE: INTRAVENOUS FLUID THERAPY

UNIT IX BLOOD TRANSFUSION THERAPY

INTERACTION ITEMS:

1. What type of reactions do you observe for with transfusions?
2. Why do you immediately connect a new administration set directly to the cannula when an adverse reaction is noted and "Y"-tubing is being used?
3. How can an air embolus be prevented during blood administration?

CLASSROOM, LABORATORY, OR OTHER ACTIVITIES:

1. Role-play nursing intervention for an adverse reaction of blood transfusion.

LESSON PLAN: 2

COURSE TITLE: INTRAVENOUS FLUID THERAPY

UNIT IX BLOOD TRANSFUSION THERAPY

EVALUATION ITEMS:

1. What are the three classifications of adverse reactions to blood transfusion?
 - a.
 - b.
 - c.
2. Identify the most active and potentially devastating reaction.
3. What is the time span in which delayed transfusion reactions may occur?
4. What is the cause of an intravascular hemolytic reaction?
5. What are the most frequently encountered transfusion reactions?
6. List the four clinical signs and symptoms of an urticaria reaction.
 - a.
 - b.
 - c.
 - d.
7. List four nursing interventions relative to all suspected transfusion reactions.
 - a.
 - b.
 - c.
 - d.

8. What type of hepatitis most commonly results from blood transfusions?
9. What year did testing of donor blood for the presence of the HTLV-III antibody (AIDS) begin?

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LESSON PLAN: 2

COURSE TITLE: INTRAVENOUS FLUID THERAPY

UNIT IX BLOOD TRANSFUSION THERAPY

ANSWERS TO EVALUATION ITEMS:

1.
 - a. Endogenous
 - b. Exogenous
 - c. Delayed
2. Intravascular hemolytic reaction
3. 48 hours to months after the transfusion
4. Human error
5. Febrile non-hemolytic reaction and urticaria reactions
6.
 - a. Local erythema
 - b. Hives
 - c. Itching
 - d. Possible fever
7.
 1. Stop transfusion
 2. KVO with N/S with new fluid set connected to cannula
 3. Notify physician
 4. Notify blood bank
8. Usually hepatitis B or non-A, non-B
9. 1985

LESSON PLAN: I
COURSE TITLE: INTRAVENOUS FLUID THERAPY
UNIT X TOTAL PARENTERAL NUTRITION

SCOPE OF UNIT:

This unit introduces participants to the principles of total parenteral nutrition (TPN) and provides guidelines of practice, that, when observed, will enable the student to provide appropriate nursing care to TPN patients.

INFORMATION TOPIC: X OR DEMONSTRATION:

TOTAL PARENTERAL NUTRITION AND NURSING PRACTICE
(Lesson Title)

LESSON OBJECTIVES - THE STUDENT WILL BE ABLE TO:

1. Define total parenteral nutrition (TPN).
2. Recognize terms describing TPN.
3. Recognize indications for TPN.
4. Recognize TPN solution principles.
5. List four potential complications of TPN.
6. Name the nursing duty to be followed in cases of suspected sepsis with fever.
7. List six recommendations of practice in TPN therapy.
8. Recognize nursing considerations in fat emulsion therapy.

SUPPLEMENTARY TEACHING/LEARNING ITEMS:

1. Container of TPN solution
2. Sample of TPN non-PVC tubing

INFORMATIONAL ASSIGNMENT:

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INTRODUCTION:

A knowledge of the metabolic implications and technical aspects of TPN therapy is essential to recognize and maximize the benefits and minimize the risks and potential complications associated with this therapy.

LESSON PLAN: 1

COURSE TITLE: INTRAVENOUS FLUID THERAPY

UNIT X TOTAL PARENTERAL NUTRITION

OUTLINE: (Key Points)

- I. Definition - provision of nutrients by vein, in amounts sufficient to achieve anabolism (II-1)
- II. Terms Descriptive of Therapy
 - A. Total parenteral nutrition (TPN)
 - B. Intravenous hyperalimentation (IVH)
 - C. Hyperalimentation
- III. History
 - A. Development began in early 1960's in the Harrison Department of Surgical Research at the University of Pennsylvania Hospital
 - B. First successfully treated patient - a severely ill infant suffering from a small bowel atresia
- IV. Indications
 - A. Inability to ingest nutrients by enteral route in quantity sufficient to meet nutritional requirements
 - B. Any clinical condition that prevents a patient from utilizing the gastrointestinal tract for maintenance or achievement of anabolism
- V. Solutions
 - A. Wide variety of solution types now commercially available
 - B. Composition
 - I. Protein
 - a. Essential amino acid
 - b. Non-essential amino acid
 2. Carbohydrate
 - a. Glucose (dextrose)
 - b. Sucrose
 - c. Fructose

3. Electrolytes
4. Minerals
5. Vitamins
6. Trace elements such as copper and zinc

C. Tonicity

1. Majority of solutions are very hypertonic (II-2)
 - a. Should be administered into a wide diameter blood vessel where rapid dilution will prevent vein sclerosis
 - b. X-ray verification of catheter placement is mandatory.
2. 10% or less hypertonic dextrose may be administered peripherally (dependent upon individual institutional policy)

D. Preparation of total parenteral nutrition solutions

1. Should be prepared in pharmacy with stringent aseptic technique
2. Solution container must be inspected for integrity
3. Solution should be inspected to ascertain presence of
 - a. Particulate matter
 - b. Turbidity
4. Prepared solutions should be refrigerated until use

VI. Flow Rate

- A. Should be infused at a constant rate - use electronic flow control device (II-3)
- B. Container should be time-stripped
- C. Check rate frequently
 1. Every 30 minutes with gravity-assist device (controller)
 2. Every one (1) hour with positive pressure device (pump)
- D. Abrupt termination could result in hypoglycemia
- E. Ensure continuity of flow if transported to other area of hospital (e.g., for testing)
 1. Nurse should accompany if possible
 2. Nursing personnel in area of designation should be alerted so that they may become responsible for flow rate maintenance

VII. Potential Complications

A. Technical

1. Catheter-associated
 - a. Clotting
 - b. Breakage
 - c. Dislodgement
2. Air emboli
 - a. During tubing change
 - b. Accidental disconnection of tubing junction
 - c. Through a tract left after catheter removal

B. Sepsis

1. Usually caused by organisms at the catheter insertion site that migrate along the catheter, rather than from in-line contamination.
2. Catheter sepsis typically presents as a low-grade fever for several days, progressing gradually to a high fever.
3. In all cases of suspected sepsis when fever presents, thorough culturing is necessary to determine the etiology of the fever.

C. Metabolic

1. Glucose intolerance
 - a. Initial infusion should begin slowly
 - b. Gradual increase in flow rate approximately 25 ml per hour per day, allows the pancreas to establish and maintain the increased insulin production necessary
 - c. Assistance of exogenous insulin may be necessary
 - d. Glucose tolerance may be compromised by
 - (1) Sepsis
 - (2) Stress
 - (3) Shock
 - (4) Hepatic and renal failure

- (5) Starvation
 - (6) Diabetes
 - (7) Pancreatic disease
 - (8) Some medications - certain steroids, diuretics, and tranquilizers
 - f. The elderly and the very young are particularly susceptible to glucose intolerance.
2. Hypoglycemia
- a. Defined as a serum glucose level of less than 50 mg per 100 ml
 - b. Cause
 - (1) Abrupt termination TPN
 - (2) Abrupt decrease in flow rate of TPN
 - c. Symptoms
 - (1) Occipital headache
 - (2) Weakness
 - (3) Cold, clammy skin
 - (4) Chills
 - (5) Dizziness
 - (6) Tingling - extremities or mouth
 - (7) Nervousness/irritability
 - (8) Confusional lethargy
 - (9) Coma
 - (10) Diaphoresis
3. Hyperglycemia - result of body's inability to metabolize the glucose in the TPN solution
4. If unchecked may progress to hyperosmolar nonketotic coma
5. If untreated - death can result

6. Reversal of state requires:
 - a. Immediate discontinuation of TPN solution
 - b. Aggressive fluid and electrolyte replacement
 - c. Correction of hyperglycemia by insulin administration
 - d. Correction of acidosis with bicarbonates

VIII. Recommendations of Practice (II-4)

- A. Urine should be tested for glucosuria at least every six (6) hours.
- B. Daily weight should be obtained.
- C. Daily intake and output monitoring
- D. Encourage active physical exercise to promote protein anabolism.
- E. Monitor vital signs every eight (8) hours.
- F. Observe patient's skin turgor.
- G. Dependent/generalized edema should be immediately recognized and reported.
- H. Observe and note physical and mental changes.
- I. Close regular monitoring of blood levels
- J. Initial infusion of TPN solution should be increased only in gradual systematic increments in flow rate/volume.
- K. Routine discontinuation of TPN solution involves gradual and systematic decrease in flow rate/volume.
- L. Nurse must be aware that certain drugs may interfere with accurate results and interpretations of urinary glucose tests.

IX. Intravenous Fat Emulsion/Lipids

- A. Classifications
 1. Essential fatty acids
 2. Non-essential fatty acids
- B. Reasons for administration
 1. To prevent and/or treat essential fatty acid deficiency
 2. As a major energy source in the nutritional regimen

- C. Fat emulsions available in the U.S. today
 - 1. Intralipid - 10% and 20%
 - 2. Lyposin - 10% and 20%
 - 3. Travalumulsion - 10% and 20%
 - 4. Soyacal - 10% and 20%
- D. Calories provided
 - 1. 10% - 1.1 calorie per milliliter
 - 2. 20% - 2 calories per milliliter
- E. Flow rate
 - 1. 10% fat emulsion
 - a. Begin infusion at 1 ml/min for first 15-30 minutes.
 - b. If no complications develop, increase rate to correspond with ordered time span for infusion.
 - (1) Should not infuse in less than four (4) hours
 - (2) Should not infuse for longer than 12 hours
 - 2. 20% fat emulsion
 - a. Begin infusion at 0.5 ml/min for first 15-30 minutes.
 - b. If no complications develop, increase rate to correspond with ordered time span for infusion.
 - (1) Should not infuse in less than eight (8) hours.
 - (2) Should not infuse for longer than 12 hours
- F. Reactions
 - 1. Immediate (up to 2½ hours)
 - a. Elevation in temperature
 - b. Flushing, sweating
 - c. Pressure sensation over the eyes
 - d. Nausea and vomiting
 - e. Headache

- f. Chest and back pains
 - g. Dyspnea
 - h. Cyanosis
- 2. Delayed (within 10 days)
 - a. Hepatomegaly
 - b. Splenomegaly
 - c. Thrombocytopenia
 - d. Focal seizures
 - e. Hyperlipemia
 - f. Hepatic damage
 - g. Jaundice
 - h. Hemorrhagic diathesis (a developed bleeding tendency)
 - i. Gastroduodenal ulcer
- G. Contraindications to fat emulsion therapy - disturbances in normal fat metabolism
 - 1. Pathologic hyperlipemia
 - 2. Lipoid nephrosis
 - 3. Acute pancreatitis if accompanied by hyperlipemia
- H. Nursing considerations
 - A. Inspect the emulsion for separation or an oily appearance. Discard if present.
 - B. Use non-PVC tubing supplied by the manufacturer.
 - C. Do not filter.
 - D. Do not retain partially-used containers.
 - E. May be infused as a solo infusion or simultaneously with the dextrose-amino acids solution, through a "Y"-connector located near the infusion site.
 - F. Patient's ability to eliminate infused fat from the circulation should be monitored.

- X. Summary and Conclusion
 - A. Definition
 - B. Terms descriptive of therapy
 - C. History
 - D. Indications
 - E. Solutions
 - F. Flow rate
 - G. Potential complications
 - H. Recommendations of practice
 - I. Intravenous fat emulsions/lipids

LESSON PLAN: 1

COURSE TITLE: INTRAVENOUS FLUID THERAPY

UNIT X TOTAL PARENTERAL NUTRITION

INTERACTION ITEMS:

1. Why is TPN used?
2. Why should TPN be administered in large veins?
3. Why should flow control devices be used when administering TPN?
4. Why is urine tested for glycosuria at least every six hours?

CLASSROOM, LABORATORY, OR OTHER ACTIVITIES:

LESSON PLAN: 1

COURSE TITLE: INTRAVENOUS FLUID THERAPY

UNIT X TOTAL PARENTERAL NUTRITION

EVALUATION ITEMS:

For each of the following, choose the correct answer and write the letter or number in the blank provided.

- ___ 1. TPN is:
- a. Provision of nutrients intravenously in amounts sufficient to achieve catabolism.
 - b. Provision of necessary O₂ carrying RBC's to carry nutrients to and from the cell
 - c. Provision of nutrients intravenously in amounts sufficient to achieve anabolism
- ___ 2. Total parenteral nutrition is also described as:
- a. Hypodermoclysis
 - b. Intravenous hyperalimentation (IVH)
 - c. Hyperalimentation
 - 1. a, c
 - 2. b, c
 - 3. All of the above
- ___ 3. Hypertonic TPN solutions:
- a. Should be given in a large blood vessel
 - b. Require rapid dilution of blood
 - c. Need x-ray placement verification of catheter after insert
 - 1. a, b
 - 2. a, b
 - 3. All of the above
- ___ 4. TPN solutions:
- a. May be prepared by the nurse in the med room with stringent aseptic technique
 - b. Will contain small amounts of particulate due to the content of many nutrients
 - c. Should be prepared, stored and given at room temperature to avoid venous spasm and constriction
 - 1. a, b
 - 2. None of the above
 - 3. All of the above

- ___ 5. When monitoring TPN flow rates:
- a. Check rate every hour with positive pressure device (pump)
 - b. Check rate every 30 minutes with gravity-assist device (controller)
 - c. Container should be time-stripped
 - 1. a, c
 - 2. a, b
 - 3. All of the above
- ___ 6. Hypoglycemia is caused by:
- a. Abrupt termination of TPN
 - b. Abrupt increase in flow rate of TPN
- ___ 7. Which of the following is not a nursing consideration in fat emulsion therapy?
- a. Discard if separation or oily appearance on inspection.
 - b. Use non-PVC tubing supplied by manufacturer.
 - c. Always use a filter.
 - d. Do not retain partially-used containers.
- ___ 8. List four potential complications of TPN.
- a.
 - b.
 - c.
 - d.
9. If fever is present, what must be done to determine the etiology of suspected sepsis?
10. Name six recommendations of practice for TPN therapy.
- a.
 - b.
 - c.
 - d.
 - e.
 - f.

LESSON PLAN: I

COURSE TITLE: INTRAVENOUS FLUID THERAPY

UNIT X TOTAL PARENTERAL NUTRITION

ANSWERS TO EVALUATION ITEMS:

1. c
2. 2
3. 1
4. 2
5. 3
6. a
7. c
8. The student may list any four of the following
 - a. Clotting of catheter
 - b. Breakage of catheter
 - c. Dislodgement of catheter
 - d. Air embolism
 - e. Sepsis
 - f. Metabolic disturbances
Glucose intolerance
Hypoglycemia
Hyperglycemia
9. Through culturing
10. The student may list any six of the following
 - a. Urine tested for glycosuria at least every six (6) hours
 - b. Daily weight
 - c. Daily intake and output
 - d. Encourage physical exercise
 - e. Monitor vital signs every eight (8) hours
 - f. Observe skin turgor
 - g. Note and report edema
 - h. observe physical and mental changes
 - i. Close monitoring of blood levels
 - j. Be cognizant of abnormal serum levels of nutrients being managed
 - k. Increase initial TPN in gradual flow rate/volume
 - l. When routine discontinuance - decrease gradual flow rate/volume
 - m. Be aware certain drugs may interfere with results and tests

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Learning Objectives for Intravenous Fluid Therapy Course for the LPN

Student Name: _____

Permanent Address: _____

Social Security Number: _____

Instructor's Signature: _____

Directions: This profile provides a permanent record for student, instructor, and/or industry representative. The objectives listed below correspond directly to the lessons presented in this curriculum guide. Compile your evaluation of the student (trainee) by transferring the appropriate "yes/no" rating from the various demonstration lessons, or by indicating "yes/no" if the student (trainee) has mastered objectives contained in information lessons.

YES	NO	Introduction To Radiology 1. Successfully completed anatomy and physiology pretest 2. Successfully completed pharmacology pretest 3. Successfully completed asepsis pretest 4. Define the purpose of IV Therapy course 5. Identify objectives of IV Therapy Course 6. Define administration of IV treatment per MO Nursing Practice Act 7. Identify functions and duties of LPN in performing IV fluid therapy per MO Nursing Practice Act 8. Explain differences between institutional policies and state regulations 9. Identify examples of negligence/malpractice in performance of IV therapy 10. Identify principles in avoiding malpractice lawsuits	YES	NO	25. State the number of liters of blood in adult 26. List three functions of blood 27. Match formed elements in blood to correct functions 28. List steps of the blood clotting process in order 29. Name factors which can alter the normal blood clotting process Fundamental Aspects of Fluid and Electrolyte Balance 30. Name percentage of body weight composed of water for prematures, infants, adults, elderly 31. Name a function of water 32. Name a normal source of water 33. Identify major organs regulating fluid output 34. List nursing responsibilities when monitoring fluid balance 35. List fluid compartments 36. Name functions of electrolytes 37. List major electrolytes 38. Define acid-base balance 39. List buffer systems 40. Identify nursing objective in fluid and electrolyte imbalances 41. Define types of fluid and electrolyte imbalances 42. Match types of fluid and electrolyte imbalances to correct causes and symptoms 43. Identify types of acid-base imbalances 44. List possible related causes for acid-base imbalances 45. Match terms related to parenteral fluids to correct definitions 46. List three official requirements of intravenous fluids 47. Identify specific IV fluids and indications for use 48. List systemic dangers in administration of specific intravenous fluids	YES	NO	Recognition and Prevention of IV Therapy Related Complications 49. Define terms associated with local and systemic complications 50. Match symptoms to complications 51. Match nursing interventions to complications 52. Name intrinsic factors in contamination of the IV system 53. Name extrinsic factors in contamination of the IV system 54. Identify preventive measures for infection control 55. Identify CDC guidelines for prevention of IV therapy related infections 56. Identify CDC guidelines for preventing transmission of the AIDS virus Administration of Intravenous Fluid Therapy 57. State rationale for patient preparation for IV therapy 58. Name areas to cover in a teaching plan 59. List factors influencing patient's anxiety in receiving IV therapy 60. List the patient's personal psychosocial resources 61. Identify effects of stress on patient's nervous system, cardiovascular system, emotional status 62. Identify nursing approaches for emotional support of an IV therapy patient 63. Name factors causing patient noncooperation 64. List nursing approaches for dealing with an uncooperative patient 65. Define terms related to measurements of needles and catheters 66. List considerations in selection of cannula 67. Identify advantages and disadvantages of various types of cannula 68. Collect and assemble IV therapy equipment 69. Prepare patient for IV therapy
YES	NO	Documentation Related to Radiology 11. List elements of good documentation 12. Document specific procedures accurately	YES	NO	Anatomy and Physiology as Applied to IV Therapy 13. Identify functions of the skin 14. Identify layers of the skin 15. Differentiate between arteries, arterioles, veins, venules, and capillaries 16. Locate four structures of a vein 17. Match veins of upper extremity and torso to location 18. List predisposing factors to vasovagal reaction 19. Match cardiopulmonary anatomy and physiology terms to correct definitions 20. Identify anatomical structures of the heart 21. State the function of the heart 22. List IV therapy related factors that can cause alterations to the cardiopulmonary system 23. Trace the circulation of blood through the cardiopulmonary system 24. Match hematology terms to correct definitions			

YES NO

70. Insert intravenous over-the-needle cannula
 71. Insert intravenous winged-tip needle
 72. Insert/convert to heparin lock
 73. Identify principles of pediatric fluid and electrolyte balance
 74. Match equipment and site selections for the pediatric patient to correct statements
 75. Identify principles of nursing care of the pediatric patient
 76. Name daily pediatric chart records that the nurse is responsible for
 77. State purpose for administration of only preservative-free heparin flush to neonates
 78. List pediatric-specific IV therapy procedures
 79. Identify age-related differences of the geriatric patient
 80. Identify psychological changes associated with the geriatric patient
 81. Identify intravenous principles in site selection, cannula insertion, and IV maintenance of the geriatric patient
 82. List IV therapy related conditions for which the geriatric patient is at greater risk

YES NO

- Intravenous Fluid Therapy Maintenance**
 83. List hazards related to inaccurate infusion rate
 84. Identify principles of maintenance of flow rate
 85. Identify principles of changing fluid containers, administration set tubing components, and site dressings
 86. Identify principles of replacement of peripheral cannula
 87. Identify principles of changing entire intravenous system
 88. Identify principles of maintaining and monitoring heparin lock patency
 89. Calculate flow rates for millimeter per hour and drops per minute
 90. Change intravenous fluid container
 91. Change administration set tubing
 92. State purpose for applying armboard/restraint
 93. List indications for use of armboard
 94. Identify principles of restraint application
 95. Apply an armboard
 96. State purpose of IV site dressing change
 97. State factors which determine dressing change schedule
 98. List site observations indicative of complications
 99. Care for infusion site
 100. State purpose of heparin flush
 101. List factors which determine heparin flush schedule
 102. Perform heparin flush
 103. Discontinue IV infusion

YES NO

- Intravenous Medication**
 104. State major objectives of drug administration
 105. List advantages and disadvantages of the IV route
 106. Name factors affecting responses to drugs
 107. Match types of incompatibilities to descriptions
 108. List ways to prevent incompatibilities
 109. Define primary types of drug interactions
 110. List factors affecting drug/admixture stability
 111. State the five rights of accurate drug administration
 112. List modes of intravenous administration
 113. Match drug reactions to correct descriptions
 114. Identify signs and symptoms of different types of reactions
 115. List immediate treatment elements to prevent death from Type I reactions
 116. List signs and symptoms of allergic reactions in patient with no previous allergy history
 117. Identify terms and abbreviations used in IV medication dosage calculation
 118. Convert equivalencies
 119. Calculate volume needed to give a prescribed dose
 120. Calculate dosage needed to give a prescribed dose
 121. Calculate mcgm/kg/minute
 122. Convert mcgm/kg/minute to mcgts/minute
 123. Administer IV piggyback meds with continuous tubing
 124. Administer IV piggyback meds via heparin lock
 125. Administer IV piggyback meds via secondary line with established primary line
 126. Administer IV meds via volume-control set
 127. Administer med via direct injection
 128. Identify basic concepts of chemotherapy
 129. Define role of LPN in chemotherapy
 130. Identify safety precautions when caring for patients receiving cytotoxic drugs
 131. List signs/symptoms of toxicity/side effects
 132. Name nursing responsibilities to the chemotherapy patient

YES NO

- Blood Transfusion Therapy**
 133. Name the ABO blood type considered the universal donor
 134. Name objectives of transfusion therapy
 135. State which parenteral solution is appropriate for initiation/facilitation of delivery of blood/blood components

YES NO

136. Define role of LPN in blood transfusion administration
 137. Identify principles of blood administration
 138. Name classifications of adverse reactions to blood transfusion
 139. Identify the most acute and potentially devastating reaction to blood transfusion
 140. State the time span in which delayed transfusion reactions may occur
 141. Name the cause of an intravascular hemolytic reaction
 142. List the most frequent transfusion reactions
 143. List clinical signs/symptoms of urticaria reaction
 144. List nursing interventions relative to all suspected transfusion reactions
 145. Name the type of hepatitis most commonly resulting from blood transfusions
 146. State the year that testing donor blood for HTLV-III antibody (AIDS) was begun

YES NO

- Parenteral Nutrition**
 147. Define TPN
 148. Recognize terms describing TPN
 149. Recognize indications for TPN
 150. Recognize TPN solution principles
 151. List potential complications of TPN
 152. Name the nursing duty to be followed in cases of suspected sepsis with fever
 153. List recommendations of practice in TPN therapy
 154. Recognize nursing considerations in fat emulsion therapy

This is to Certify that:

*Achieved the Learning Objectives
as Acknowledged for
IV Fluid Therapy Course for the LPN
And is Therefore Recognized*

This _____ Day of _____, 19 _____

Instructor

Administrator